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# A Study of Undergraduate Perception and Behavior Toward On-Campus Composting

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# A STUDY OF UNDERGRADUATE PERCEPTION AND BEHAVIOR TOWARD ON-CAMPUS COMPOSTING

by

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## Abstract

Composting among college students can promote a healthy environment and encourage the appropriate disposal method for generated organic wastes. The purpose of this study was to observe composting behaviors and attitudes among students and foster an increase in knowledge of suitable composting behavior in on-campus apartments.

Waste management issues are quickly becoming a key societal concern. As a result, there has been extensive literature surrounding the benefits of, and factors leading to, pro-environmental behaviors. What specific factors lead an individual, institution, or community to begin composting? In analyzing research on related topics, we can investigate drivers that are transferable to increase composting participation. Through survey analysis and implementation of an on-campus composting program this study found that undergraduate students living in the on-campus apartments at University of Maine's undergraduate have positive feelings and attitudes towards composting and sustained interest in practicing environmentally conscious behaviors. The positive perception of composting that students expressed can be expanded into change within the university community.

Acknowledgements

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# INTRODUCTION

## Topic and Motivation

Composting among college students can promote a healthy environment and encourage the appropriate disposal method for generated organic wastes. The purpose of this study was to observe composting behaviors and attitudes among students and foster an increase in knowledge of suitable composting behavior in on-campus apartments. My interest in composting began during an internship on the Materials Management Team at the Senator George J. Mitchell Center for Sustainability Solutions. I learned about waste management policy in Maine and the critical nature of the issue. Everyday over 5,000 tons of municipal solid waste are generated in Maine and new locations for waste disposal is limited and difficult to site in any community. This drove me to want to engage with students about materials management at the University of Maine and teach them about waste reduction and diversion. Through collaboration with Margaret Chase Smith Public Policy Center, University of Maine Facilities Management, and the Senator George J. Mitchell Center for Sustainability Solutions I was able to create a pilot program to conduct my research objectives. These objectives included minimizing the organic materials that are wasted and maximizing their diversion to UMaine's composting facility while also engaging with university students and encouraging them to compost. This is not only to reduce tons of compostable organics going to a landfill, but also to promote this sustainable behavior that can be carried forward for the rest of each student's life.

# REVIEW OF LITERATURE

## Composting

Composting is a biological process where organic matter is decomposed under elevated temperatures (*Sustainable Management of Food*). To produce compost, "green materials," such as food scraps and yard trimmings, are mixed with "brown materials," such as wood chips and straw (*A Beginner's Guide to At-Home Composting*, 2017). The "brown materials" are added to increase the rate of decay of the "green materials" (EPA, 2016). The process ends once the materials are cured, meaning the heating process has ended (Masley, 2016). Compost not only diverts waste from landfills it also has many valuable applications (EPA, 2016). Composted materials can be used to improve habitats though improving nutrient deficient soils (EPA, 2016). According to the Environmental Protection Agency (2016) compost is a cost effective solution to soil remediation projects compared to traditional soil, water and air pollution technologies. The term "food waste" is a misnomer when talking about food that can be diverted from a landfill. Uneaten food is a "resource" and has a value whether it goes to feeding a hungry person, or to feeding the land.

## Soil Health

Compost can improve soil quality and structure (Benefits and Uses, 2016). According to the University of Illinois Extension, "soil structure refers to how inorganic particles, such as sand, combine with decayed organic particles, such as compost" (Benefits and Uses, 2016). Composting is one method to treat bio-solids and organic

material, to create a marketable end product that is easy to handle, store, and use. The end product is categorized as a "Class A, humus-like material without detectable levels of pathogens that can be applied as a soil conditioner and fertilizer to gardens, food and feed crops, and rangelands" (Use of Composting for Biosolids Management). The compost provides large quantities of organic matter and nutrients (such as nitrogen and potassium) to the soil, improves soil texture, and elevates soil cation exchange capacity (an indication of the soil's ability to hold nutrients), all characteristics of a good natural fertilizer (Use of Composting for Biosolids Management). Additionally, healthy soil supports biological growth and preserves ecosystems, as well as helps to create visually appealing landscapes (Pantsios, 2016).

## The University Setting

One method of overcoming unsustainable practices is through education. Institutions of higher learning can increase sustainability through student participation, along with faculty and administrative support, of food scrap management in dining halls and university housing. Universities can significantly reduce pre-consumer and post-consumer waste through policies that provide the opportunity for individuals and employees to compost their food scraps. By taking the lead, universities, and all other institutions for learning, can enhance society's management of organic materials through providing access to composting programs, a key topic this paper will look to understand.

The University of Maine established the "first facility for advanced composting of food waste in Maine" ("UMaine Opens New Campus Composting Facility - UMaine News - University of Maine," 2013). This was a result of collaborative efforts between

the University of Maine Dining Services and University of Maine Cooperative Extension. This effort has resulted in nearly 1 ton of pre-consumer food waste being diverted from landfills every day during the academic year ("UMaine Opens New Campus Composting Facility - UMaine News - University of Maine," 2013). The University of Maine fraternity, Beta Theta Pi, has also been allowed to compost their food scraps and has collected it weekly for the past two years. With these structures in place, expanding to upperclassmen housing was a logical next step.

Bowdoin College, a private, liberal arts college located in Brunswick, Maine, began working to reduce their food scraps in 2015. In an effort to reduce leftover food, dining halls began to forecast the food production using a food management software (Composting and Food Waste). If substantial overproduction does occur, the dining hall's work with students to deliver leftovers to local non-profit organizations (Composting and Food Waste, 2016). The connection between food scraps and food insecurity is an important one as feeding hungry people is a higher priority than composting on the EPA's Food Waste Hierarchy (Food Recovery Hierarchy, 2016). Bowdoin also diverts pre- and post- consumer food scraps to both a local farm as animal feed and works with a local composting company to compost what the farm can't use ("Composting and Food Waste," 2016).

Southern Maine Community College (SMCC) started their composting program in September 2015. Their composting system, called "The Rocket," is in-vessel, which helps to reduce odors and the attraction of critters (Hoffman, 2015). Dave Palm, an instructor of Horticulture at Southern Maine Community College and leader of the project, has stated that the "Rocket" will "initially be used for food scraps from the

Culinary Arts program and McKernan Center's many events and buildings located at SMMC" (Hoffman, 2015). From the Rocket's implementation in September, 2015 to November, 2015 twenty eight thousand tons of organic waste were diverted from landfilling (Hoffman, 2015).

The College of the Atlantic (COA) is a private liberal arts college located in Bar Harbor, Maine. Their compost program involves systems at their farms and dining services which yield four tons of compost a year from pre-consumer waste and six tons from post-consumer waste. That is a remarkable feat given their campus population of 385 students and faculty. Compostable plates, cups, and utensils used at special events are processed off-campus at a commercially licensed facility (Waste Minimization & Recycling). COA undergoes an in-depth annual waste audit every October where they assess their effectiveness in diverting materials and make plans for how to continue to enhance their food scrap management practices. They employ a graduate assistant specifically to help promote excellent materials management at their college promoting their reduction, reuse, recycling, and composting initiatives.

Across the country institutions of higher learning are setting out to reduce their disposal of organic materials in landfills. The University of Maine, Bowdoin College, Southern Maine Community College, and the College of the Atlantic may vary in their size, structure, and background, but each of these Maine educational institutions are tackling organics management using a method that best serves their needs. Efforts to divert compostable materials on campuses present an opportunity to educate the campus community through compost monitoring interactions, and to motivate staff and students

to participate in these efforts. These campus composting programs can be effective in raising students' awareness of composting and environmental issues.

## Different Methods of Composting

The primary objective of composting is to return nutrients to the soil, thus completing the nutrient cycle. There are several different available methods to achieve that goal including composting, anaerobic digestion, and dry fermentation. Although the latter two methods have the added benefit of producing and capturing energy, they also have the drawbacks of being capital intensive and technical to manage. Composting is an accessible activity that anyone can begin in its simplest form in their backyard. There are five major methods of composting for communities to consider when diverting food scraps which include: (1) onsite composting, (2) vermicomposting, (3) aerated (turned) windrow composting, (4) aerated static pile composting, and (5) in-vessel composting (Types of Composting and Understanding the Process, 2016).

Onsite composting is well suited for organizations who are composting small quantities of wasted food onsite and can help divert food scraps from the trash (Types of Composting, 2017). This method is advantageous because of its simplicity. Outdoor composting bins can be purchased or economically built from scrap wood or old garbage cans. Most vegetable-based food scraps can be used to make onsite compost, including fruit and vegetable waste, egg shells, leftover pasta or rice, coffee grounds and teabags, nut shells and bread. This method is not an option for composting animal products or large quantities of food scraps (Types of Composting, 2017).

Vermicomposting is another method of composting where organic materials are fed to red worms in bins to create compost (Types of Composting and Understanding the Process, 2016). The worms digest the organic material and produce compost. This method works well for those living in urban areas or apartments because the entire process is done indoors using a worm composting bin called a "vermicomposter" (Types of Composting and Understanding the Process, 2016). However, the bin may give off unpleasant smells if food is not buried. One pound of mature worms, approximately eight hundred to one thousand worms, can consume half a pound of organic material per day (Types of Composting and Understanding the Process, 2016). The food scraps collected in vermicomposters are turned into castings, which take three to four month to produce, and can then be used as potting soil (Types of Composting and Understanding the Process, 2016). Another byproduct of this method is called "worm tea" which is used as liquid fertilizer for houseplants or gardens (Types of Composting and Understanding the Process, 2016).

Aerated (Turned) Windrow Composting can be used when large volumes of organics are generated (Types of Composting, 2017). This method is a solution for communities and high volume food-processing businesses interested in diverting organics (Types of Composting and Understanding the Process, 2016). This method produces large volumes of compost that can be bagged and sold. The compost is created by positioning the organic waste into rows of long piles and regularly aerating them either manually or mechanically by turning the piles (Types of Composting and Understanding the Process, 2016). The ideal pile height is between four and eight feet with a width of fourteen to sixteen feet which allows the pile to generate heat while maintaining oxygen

flow (Types of Composting and Understanding the Process, 2016). Advantages of windrow composting are that it requires no source of electricity, windrows can be built in the fields, where the compost will be used, and farmers can usually use existing equipment to make and maintain the piles (Types of Composting and Understanding the Process, 2016). A drawback of this method is the pile temperature must be watched to avoid odor problems and ensure that the ingredients are composting (Types of Composting and Understanding the Process, 2016).

Aerated static pile is similar to Aerated (Turned) Windrow Composting but instead of the material being spread into "windrows" or rows it is pushed into an enormous pile (Types of Composting, 2017). The pile consists of organic waste materials usually produced by local governments, landscapers, or farms (Types of Composting and Understanding the Process, 2016). The pile is created by mixing organic waste with brown material, such as wood chips, which allows for air flow (Types of Composting and Understanding the Process, 2016). Depending on the size, the pile it may be built over a system of piping with temperature or timed sensors to deliver or remove air (Types of Composting, 2017). A drawback of this method is it cannot be used when composting animal byproducts or grease from food processing industries (Types of Composting and Understanding the Process, 2016). Another disadvantage of this method is it requires a source of power, therefore increasing the cost and logistics associated with managing a pile.

Both the aerated (turned) windrow composting and the in-vessel composting methods are capable of processing large amounts of waste (Types of Composting and Understanding the Process, 2016). The advantage of in-vessel composting is it requires

less space and can compost any form of organic waste including meats, animal manure, bio-solids, and food scraps (Types of Composting and Understanding the Process, 2016).

The in-vessel composting method begins with feeding organic materials into an enclosed structure, usually a drum or concrete-lined trench, which controls for environmental conditions (Types of Composting and Understanding the Process, 2016). Next, the material is mechanically turned for several weeks to aerate the mixture and produce the compost (Types of Composting and Understanding the Process, 2016). Although this method requires little space and time to complete, a disadvantage is the cost to implement and maintain this type of system (Types of Composting, 2017).

## Legislation on Organics

Officials are beginning to recognize the environmental benefits that occur when food waste reduction programs are prioritized (Abbey-Lambertz, 2016). In recent years, several states have implemented state-level policies to reduce food waste. Some organics bans prohibit certain entities from disposing of organics, including food scraps, in landfills (Leib, 2016). Other states, and some localities, have implemented mandatory organic materials recycling laws, which require certain producers of organic materials to recycle organics through specific methods, such as composting (Leib, 2016). Implemented organics policies and waste recycling laws are results-driven, which provides businesses and residents with the opportunity to choose how they will prevent food waste or keep food out of landfills (Leib, 2016). Programs that cause businesses to view excess food as a resource, have the ability to put organics to good use, such as donations to food banks (Leib, 2016).

In 2012, the Vermont Legislature unanimously passed the Universal Recycling Law, Act 148 (Department of Environmental Conservation, 2016). The law was supported unanimously for two major reasons: (1) more than half of what Vermonters throw away can be diverted from landfills, and (2) useful alternatives exist for uneaten food and food scraps. Under this law three major materials are banned from disposal: (1) "blue bin" recyclables by July 2015, (2) leaf and yard debris; clean wood by July 2016, and (3) food scraps (organic, compostable kitchen wastes) by July 2020. The law includes provisions to make it possible for Vermont residents and businesses to meet each landfill (or disposal) ban by the established dates (Vermont's Universal Recycling Law, 2016). For instance, trash collection services are required to offer recycling and food scrap collection services in advance of each landfill ban going into effect (Vermont's Universal Recycling Law, 2016).

The Massachusetts Department of Environmental Protection started to legislate bans on landfilling and burning of recyclables and toxic materials in 1990 (Massachusetts Waste Disposal Bans, 2017). Additional "waste bans" have been phased in over time. Massachusetts instituted a food waste ban in 2014 that prohibits businesses and institutions generating a ton or more of food waste weekly — such as grocery stores, hospitals, colleges, breweries and larger restaurants — from disposing of food in standard dumpsters. The benefits for organizations diverting food wastes from disposal include reduced waste management costs, and should lead to savings in purchasing. Due to the waste bans, communities throughout Massachusetts have invested in systems to collect materials banned from disposal (Massachusetts Waste Disposal Bans, 2017). Additionally, this policy has had an impact on Maine as a number of businesses, most

prominently Hannaford, is disposing of their organic materials across New England at an anaerobic digester facility, Exeter-Agri Energy, in Exeter, Maine.

The Ohio Environmental Protection Agency promotes the diversion of food scraps from landfills in its communities using a variety of methods composting, anaerobic digestion and other alternatives (Ohio EPA Division of Materials and Waste Management, 2017). Through several initiatives the state has been able to divert wasted food from ugly produce and unpicked food (Ohio EPA Division of Materials and Waste Management, 2017). An example of this is the Ohio Food Purchase Agricultural Clearance Program, a partnership between the state's food bank network and over 100 farmers that has been running for seventeen years (Ohio Agricultural Clearance Program). The program receives over $9 million in state funding annually, an amount much higher than the few similar programs in other states (Ohio Agricultural Clearance Program). When farmers have surplus crops, they get reimbursed to pick, pack and deliver produce to food banks (Ohio Agricultural Clearance Program). It gives the agriculture industry an economic boost while getting fresh, healthy food to families in need (Ohio Agricultural Clearance Program).

California has implemented several initiatives to reduce food waste including source reduction, reuse, recycling, and composting efforts (Abbey-Lambertz, 2016). The state's goal by 2020 is to reduce the waste stream by seventy five percent (Abbey-Lambertz, 2016). One initiative is called the Farm to Family program, which donated more than 100 million pounds of farmers' extra crops to food banks last year (Farm to Family, 2017). The state offers tax incentives to farmers who donate produce and the haulers who transport it to nonprofits (Farm to Family, 2017). California also

implemented an organic waste law mandating the creation of organic waste recycling programs in cities (Abbey-Lambertz, 2016).

## Determinants of Sustainable Behavior

Waste management issues are quickly becoming a key societal concern again as they were during the 1980s which led to the lining of landfills. As a result, there has been extensive literature surrounding the benefits of, and factors leading to, pro-environmental behaviors. What specific factors lead an individual, institution, or community to begin composting? How can we overcome any negative stigmas that are involved with composting? What education and awareness programs are necessary to make organizations and households successful in starting a composting program? In analyzing research on related topics, we can investigate drivers that are transferrable to increase composting participation.

Mobilization of individuals within a community encourages sustainability programs to be implemented. Composting efforts in dining halls can be strengthened by the support of University of Maine students, faculty, and staff. College campuses are able to initiate sustainability programs that are vital for change in surrounding communities. Through political support and the building of coalitions in the community, campus projects can be made possible. Exploration of student's attitudes and behaviors towards on-campus composting can be useful in creation of programs necessary to help lead students to long-term sustainable behaviors.

There are several factors which may influence participation in waste management programs and other sustainable behaviors. These factors, referred to as environmental beliefs, include the perceived benefits of a behavior, difficulty of a behavior, perceived

barriers to performing a behavior, perceived effectiveness of the behavior, knowledge required to execute the behavior, and social influences on the given behavior (Hines, Hungerford, and Tomera, 1987). Perceived benefits of an environmental behavior include both personal benefits, such as saving money or feeling good, as well as societal benefits such as protection of the environment. In general, these benefits have a positive influence on environmental behavior.

For a household to undertake the task of composting, they must see that there are benefits to either member directly or indirectly through benefits to the environment. Composting requires time and effort to be done properly. It may also require financial outlays for equipment and infrastructure to purchase or build a composting bin. The benefits can be localized to the individual if they manage their own pile and have the soil amendment generated at the end of the process. The act of segregating compostable materials in the home can be difficult and, if done improperly, could cause odor issues in the home. All of these factors would lead to an individual with little motivation to compost to never begin.

## Attitude-Behavior Relationship

Attitude-behavior consistency is defined as how an individual's attitude (opinions) predicts their behavior (actions). Attitude-behavior consistency occurs when there is a relationship between a group's opinions and actions (Schacter et. al, 2016). In Hines et al.'s meta-study, attitudinal variables were defined as factors that deal with an individual's feeling, positive or negative, good or bad, towards an aspect of the environment or object related to the environment (Hines, Hungerford, and Tomera,

1987). The study found that there are primarily two types of attitudes examined: attitudes toward ecology and the environment and attitudes toward taking environmental action such as recycling, petitioning for environmental efforts, promoting conservation, and reducing energy (Hines, Hungerford, and Tomera, 1987). This work has been highly cited and utilized as a building block for environmental attitudes research to present day.

A significant determinant of attitude was societal relative advantage. In Taylor and Todd's study, societal relative advantage was defined in terms of benefits such as reducing landfill waste and helping the environment. The study found that societal relative advantages have a strong positive influence on behavior (Taylor & Todd, 1997). This reduction in landfill waste has become a focal point of the composting movement beyond soil health alone. Trash cans across the country, in particular in national parks and other areas where conservation is at the forefront, have "Landfill" on the face to remind individuals that their actions have consequences and leads to their discarded materials being sent to a hole in the ground. This type of messaging is designed to highlight the benefits of reducing garbage generation and capitalize on the negative perception of disposing materials to landfills if it can be avoided.

## Normative Influences

Normative beliefs are defined as beliefs about whether referents approve or disapprove of the behavior and contributes to subjective norms along with motivation to comply (Health Behavior and Health Education, 2016). In the case of composting, the impact of attitudes towards the behavior and visibility of participation in the behavior has been studied. The perceived reputation of a behavior in a community is a significant

factor when asking someone to practice a new behavior such as composting. Additionally, the anticipated opinion of other people and the importance of other people's opinion of the behavior is significant (Mosler, et al, 2008).

Social norms have been shown to be an important determinant of participation in some recycling programs; in particular, programs where the recycling container is collected from a highly visible location such as the front driveway (Vining & Ebreo, 1990). Other studies have shown that for household composting internal normative beliefs are slightly more influential than external ones (Taylor & Todd, 1997). This is consistent with the idea that composting is essentially a household activity, and thus more susceptible to influences from members of the household (Taylor & Todd, 1997).

However, because home composting is normally carried out in a household's back yard some studies have suggested there are less opportunities for social norms to play a role. In Edgerton, Mckechnie, and Dunleavy's study on *Behavioral Determinants of Household Participation in a Home Composting Scheme*, two normative influences were investigated: social norms and social diffusion. The study concluded neither of the variables were significant predictors of home composting participation (Edgerton, Mckechnie, & Dunleavy, 2008). This means methods previously used to encourage other sustainable practices, such as recycling, will not have the same impact on composting initiatives. It is necessary to explore other methods to encourage composting behavior. For instance, effort must be made to establish a positive social reputation as well as a common practice of composting. An easy and effective way could be some form of symbolic recognition for those who contribute to composting behavior, possibly in a public way.

## Cognitive Variables

Cognitive variables are the means people use every day to process information (Anthony, 2017). In Hines, Hungerford, and Tomera's study cognitive variables referred to knowledge of the environment or environmental issue. This included understanding of environmental issues and consequences along with knowledge on how to take action on a particular environmental problem. Their study found that there was a positive correlation between individuals with greater knowledge of environmental issues and/or knowledge of how to take action on those issues and engagement in responsible environmental behaviors than those who did not possess this knowledge (Hines, Hungerford, and Tomera, 1987).

In another study conducted in Santiago, Cuba the cognitive component of attitude (cost-value) was based on a cost-benefit estimate. The study determined that in order to introduce composting as a new behavior, communal and personal benefit of composting must be stressed to influence the cost-value ratio (Mosler, et al, 2008). This suggests that when composting is framed as an economically advantageous behavior it may lead to increased participation. Participants are more likely to want to participate in a behavior they believe will save them money and directly benefit their lifestyle.

## Verbal Commitment Relationship

Verbal commitment is defined as an expression of intent to act on a matter, in this instance an environmental problem. According to the study *Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis*, individuals who

express an intention to perform some action related to the environment were more likely to report engaging in environmental behaviors than those who expressed no such intention (Hines, Hungerford, and Tomera, 1987).

## Environmental Programs

In addition to studying behavioral determinants of sustainable behavior, several studies have looked into the relationship between food waste reduction and implementation of eco initiatives. In a study conducted at Capetown Hotels in South Africa the relationship between an eco-initiative to reduce waste and environmental sustainability was demonstrated (Wyngaardand and Ruan, 2013). Wyngaardand and Ruan's study found that implementation of eco initiatives to recycle water and food waste led to a reduction in the waste generated by a hotel (Wyngaardand and Ruan, 2013).

Another study investigated whether or not visual prompts and human models influence compost-supportive behavior by individuals in a cafeteria setting (Sussman, Greeno, Gifford, & Scannell, 2012). The focus of the study was to determine whether a relatively unstudied pro-environmental behavior (composting) could be increased in a population that was not previously performing the behavior. The study found that the likelihood of a well-executed composting program increased significantly with the addition of improved signs and multiple models (Sussman, Greeno, Gifford, & Scannell, 2012).

# METHODOLOGY

## Experimental Design and Sampling

The study was conducted with the use of pre and post questionnaires created on Qualtrics. The questions asked participants about their demographics and general attitude and knowledge of composting in order to be able to determine what factors influence student composting behavior.

## Research Hypotheses

Based on the research that has been discussed, a total of 6 hypotheses are proposed:

Hypothesis 1: Previous exposure to composting will be a significant predictor of composting behavior.

Hypothesis 2: Implementation of an on campus apartment composting program will result in waste diversion.

Hypothesis 3: The addition of signs and flyers will lead to an increase in student composting behavior.

Hypothesis 4: The gender of the student will not be a significant predictor of composting behavior.

Hypothesis 5: The location of where a participant grew up will be a significant factor of composting attitude.

Hypothesis 6: The year of the student in school will not be a significant predictor of composting behavior.

## Experimental Procedure

The process to organize this program began in May, 2016. First, a meeting with the facilities manager at the University of Maine was organized to discuss the pilot program and ask for assistance. Another meeting with the facilities manager was set up prior to the fall semester to determine logistics. A plan for the compost program was created which involved weekly pick-up of the compostable material, weighing, delivery to the composting facility and sorting to determine the level of contaminants (i.e. non-biodegradables).

The survey used to gauge student perception and behavior toward an on-campus composting program was created using Qualtrics. The survey questions were written during July, 2016. The survey was then sent to the Institutional Review Board for the Protection of Human Subjects (IRB), which must approve of any research involving human subjects, for approval. The IRB returned the survey with feedback, the survey was updated, and approved.

To recruit students for the study several measures were taken including going door to door to ask students to participate, email blasts, and flyers. During the first and second weekend of the semester students living in on-campus apartments were verbally asked to participate in the study. Students who were interested in participating provided their email addresses. Each student was emailed a link to the Qualtrics pre-test questionnaire on September 4, 2016. The questionnaire asked participants to create a unique identifier to be used to match up pre-test and post-test submissions. The unique identifier included the last four digits of their phone number and the month and day of their birthdate. The list of email addresses obtained was also used to send out a follow-up

post-test questionnaire using Qualtrics, this was sent on January 31, 2017 following the completion of the pre-test questionnaire. Consent forms were included as part of the pre-test and post-test submissions.

The students were also provided with a handout on what materials were compostable (Figure 1). Students were asked to collect their compostable materials and dispose of them in the designated compost bucket for their apartment complex. The two designated compost buckets were collected on a weekly basis. The bins from each apartment complex filled with food scraps were weighed individually each week and brought to the University of Maine Compost Facility.

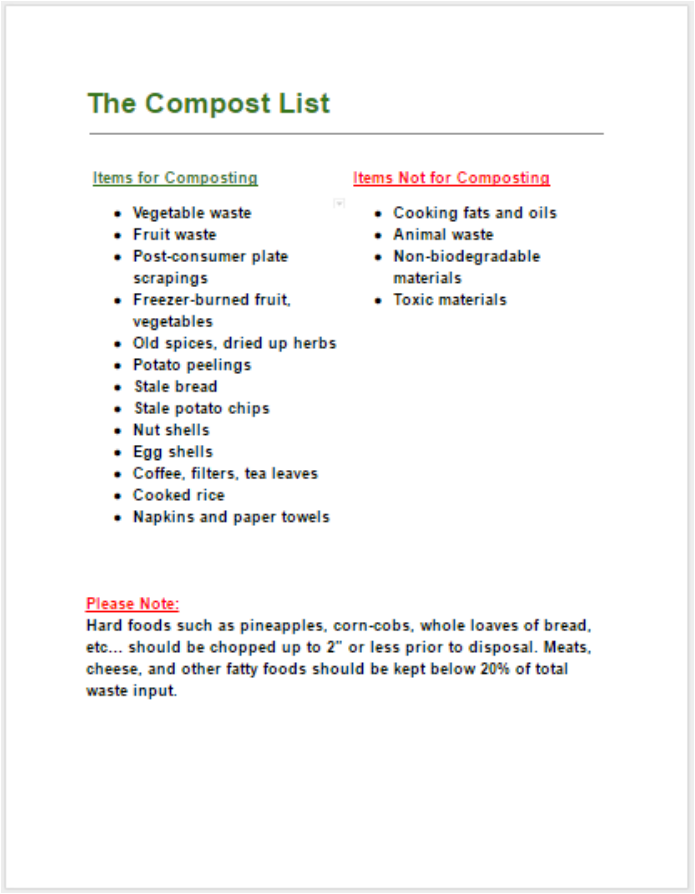

Figure 1: Compostable Material Handout

Another outreach effort to increase student participation was undertaken on October 23, 2016. Flyers about the study were distributed to each apartment in the on-campus apartment complexes and hung on bulletin boards. The flyers included the link's address to the pre-test questionnaire.

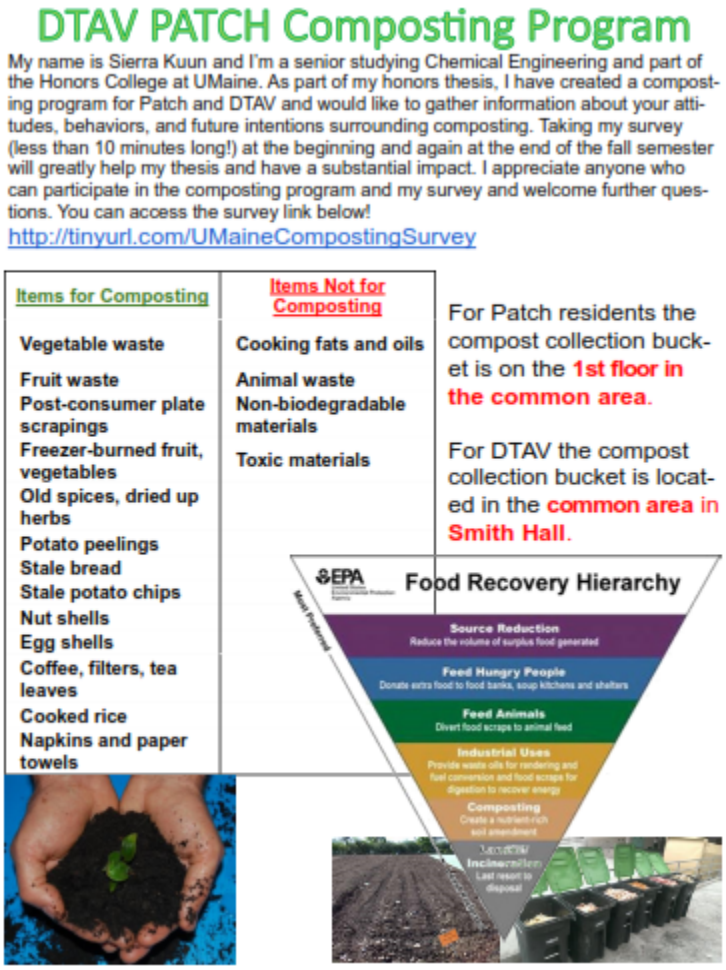


Figure 2: Compost Program Flyer

## Survey Analysis

The survey data was analyzed and tested in two primary ways. First the data was looked at in ordinal form by the student responses of the questions of which a majority utilized a Likert scale. A common method of analysis for this is known as "Top-Box,"

which looks for what percentage of responses are on the positive side or the negative side of the question. Using this method we can see where respondents were in agreement or disagreement toward specific topics.

The second method for analyzing the data was using parametric tests, such as t-tests and ANOVAs (analysis of variance). These methods were used to determine the statistical significance of where the respondents, stratified by various characteristics, responses were different and similar. There has been a strong push towards using Likert-Scale data in parametric data analysis (Carifio and Perla, 2008). To reinforce the validity of using parametric data, a Crombach's Alpha statistic was generated to show the reliability of the questions. The data had a high score of 0.669 indicating that there is enough internal consistency to use parametric testing. Given the small sample size, parametric testing will not be a focal point, but t-tests and ANOVAs were run and will be mentioned where there were noteworthy, statistically significant results.

A possible issue that was addressed is the small sample size resulting in being unable to use some of the questions, or forcing the pooling of results. This is not desirable, but in many cases was a minor inconvenience. For instance, instead of looking at eight different pools of individuals for "Where were you raised?" those groups were pooled into three concise and similarly sized groups: Central/Northern Maine, Southern Maine, and Outside Maine. The stratifications that are analyzed in these results are as follows: 1) gender, 2) year in school, 3) where raised, 4) number of meals cooked per week, and 5) prior composting experience.

A third form of analysis will be to look at the seven individuals that provided an identification code that was matched with both rounds of surveys to chart their story and

see what we can learn from their experience. The students participating in the survey, through their results, share a personal story of their experience composting. We can learn of the "yuck" factor, about how practice leads to perfection (or not!), and how participating in a sustainability program enhances, or detracts from, future intentions about the activity.

# RESULTS

The descriptive data collected from the questionnaires distributed among undergraduate students living in the on-campus apartments at the University of Maine are summarized in Table 1. The pre and post-test questionnaire sample size consisted of a total of 73 undergraduate students (males=39, females=33).

Table 1. Descriptive data of entire pre and post questionnaire (n) sample.

| Question | Option | Count |
|---|---|---|
| Sex | Female | 33 |
| | Male | 39 |
| | Prefer not to disclose | 1 |
| Academic Year | Junior | 36 |
| | Senior | 26 |
| | Sophomore | 11 |
| Where were you raised | Central and Northern | 27 |
| | Outside Maine | 20 |
| | Southern Maine | 26 |
| Where do you live | Alpha Tau Omega | 12 |
| | Beta Theta Pi | 9 |
| | DTAV | 16 |
| | Other | 3 |
| | Patch | 33 |
| Number of Meals Cooked per Week Excluding Breakfast | No Response | 3 |
| | 0 | 5 |
| | 1 to 4 | 7 |
| | 11 to 14 | 25 |
| | 5 to 7 | 10 |
| | 8 to 10 | 23 |
| Have you composted in the past | No | 27 |
| | Yes | 46 |

## Compostable Material

It was hypothesized that the implementation of an on campus apartment composting program would result in significant waste diversion. According to Figure 3 food scraps were diverted on a weekly basis during the regular academic calendar. The total waste diverted for the fall semester was 642.2 lbs. Figure 3 suggests many students participated in this program and were interested in practicing a sustainable behavior. There were 50 students who took the initial pre-composting survey from Patch and DTAV during the fall semester. It is likely more participated and did not fill out the information, but as a baseline, we can see that the average student likely diverted between 12 lbs (if all students participated) and 15 lbs (if only survey respondents participated) pounds of food waste. The study was unable to determine if some students waited to adopt the program during late October when the last formal advertisement was made and there was a steady increase in pounds of food scraps collected for several weeks.

Another hypothesis was that the addition of signs and flyers would lead to an increase in student composting behavior. In order to test this theory, flyers were distributed to each complex in late October. According to the data collected in Figure 3, the students collected the greatest amount of compostable materials per day in November, suggesting that the addition of flyers likely increased participation. According to Figure 3 student collection of compostable materials decreased after school holidays and breaks. This could be due to a variety of reasons such as forgetting to collect their food scraps, loss of interest in the program, or not preparing their own food as much after a break. It is common for parents and relatives to send student back to school with prepared meals, so seeing less pre-meal food scraps is to be expected.

Table 2: Average Daily Rate of Compostable Materials Collected in on-campus apartments

| Compostable Materials Collected per Day (lbs) | | | |
|---|---|---|---|
| **Date** | **Patch** | **DTAV** | **Total** |
| 9/7/2016 | 4.94 | 1.00 | 5.94 |
| 9/14/2016 | 5.43 | 1.23 | 6.66 |
| 9/21/2016 | 2.89 | 1.00 | 3.89 |
| 9/30/2016 | 5.43 | 2.74 | 8.17 |
| 10/5/2016 | 1.86 | 1.26 | 3.11 |
| 10/12 & 19/2016 | 4.52 | 3.52 | 8.04 |
| 10/26/2016 | 3.89 | 1.49 | 5.37 |
| 11/2/2016 | 6.86 | 1.57 | 8.43 |
| 11/10/2016 | 6.43 | 2.86 | 9.29 |
| 11/17/2016 | 6.31 | 3.57 | 9.89 |
| 11/14 & 12/1/2016 | 3.47 | 1.16 | 4.62 |
| 12/8/2016 | 3.67 | 1.22 | 4.89 |
| 12/15/2016 | 6.86 | 1.00 | 7.86 |
| **Average Daily** | 4.81 | 1.82 | 6.63 |
| **Total Weight** | 465.60 | 180.60 | 646.20 |

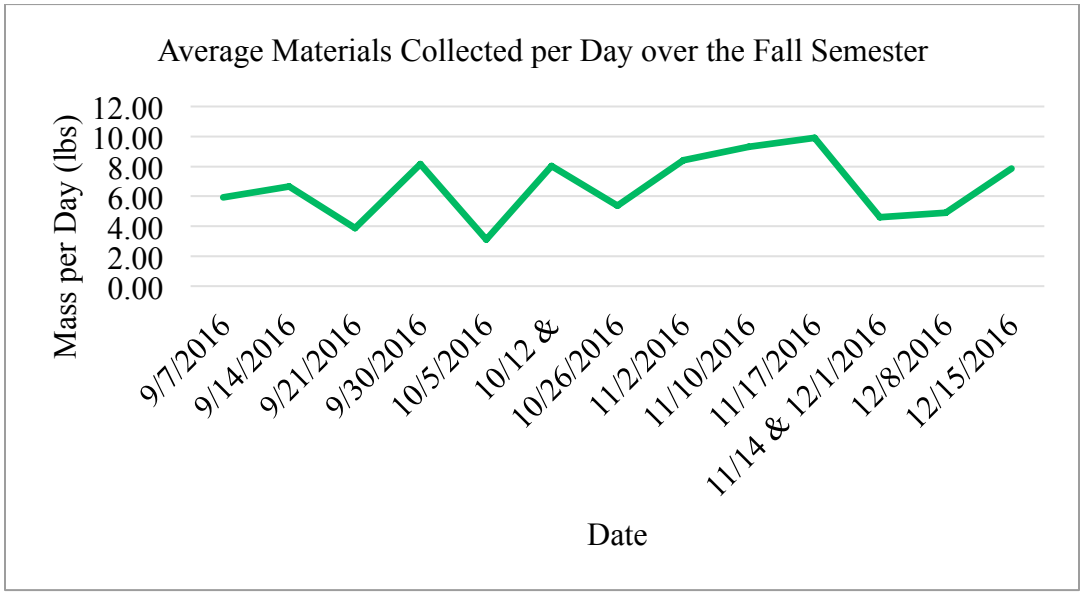


Figure 3: Average Daily Rate of Compostable Materials Collected in on-campus apartments
* Please note: school breaks were not included in calculations of averages

A noteworthy finding could be to see the higher participation of the Patch Students than the DTAV students. Students living in Patch collected 4.81 pounds per day on average versus those living in DTAV where 1.82 pounds per day on average were

collected. This project could be thought of as a coalition between two buildings, similar to towns in Maine that come together to share or have regional transfer station. I lived in the Patch apartment complex which made it easier for me to promote the program to students since I was more likely to know them and have a connection with them. In cooperatives, typically the "Champion" for a program will get stronger participation from the residents that they are more acquainted with. This translates to the situation where the town that the site is located in has a larger buy-in to the program than the town(s) that "use" the program, but may not identify with it as a part of their community.

## Impact of Previous Exposure to Composting

It was hypothesized that a participant's exposure to composting in the past would be a significant factor in predicting attitude toward composting. Students who had composted in the past were more confident in their ability to compost and to understand what material could be composted (Figure 4). These findings make sense because individuals who have experience with a practice are often more confident in their understanding of the topic and ability. Most individuals were confident that they could effectively compost without creating odors or spend money to participate. The only question that was out of the ordinary was the question about whether or not it is okay to have a little plastic in your compost. Individuals without experience answered that they disagreed with that statement 89 percent of the time, slightly above that of those with exposure to composting in the past (Appendix B, Table 1). The "Exposure" group has had the experience to conclude, right or wrong that is it an acceptable thing to have low levels of contamination.

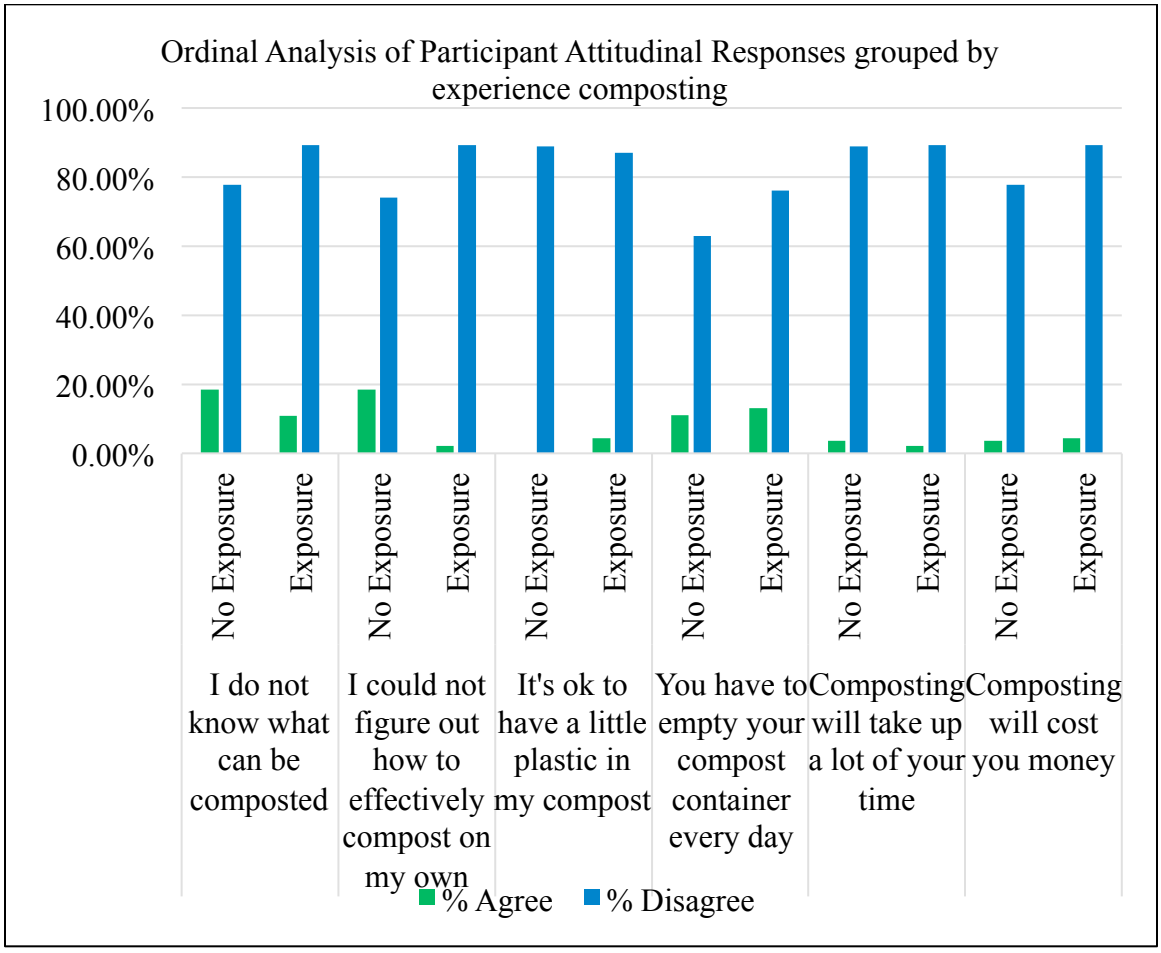


Figure 4: Graph of Ordinal Analysis of Participant Attitudinal Responses grouped by experience composting

Figure 5 shows the informational responses based on the participants experience with composting. The majority of participants in both groups had generally positive attitudes toward composting, the importance of composting, and belief in environmental benefits of composting. However, participants who had experience composting were more likely to agree that they had a positive attitude toward composting. Participants with experience composting responded positively 93.5 percent while participants with no experience composting responded positively 74 percent (Appendix B, Table 2). This can be explained by participants who have composted in the past already and thus understood

the environmental benefits of the behavior. In addition, participants with previous exposure to composting were more likely to respond positively to composting in the future. Another finding was that only individuals without prior exposure to composting disagreed with the questions "do you plan on composting later in life." Both of these questions in the informational block had robust statistically significant differences of responses along with the question pertaining to understanding the process of composting. It also reinforces the idea that exposure to a sustainability-related activity helps fosters future actions. This is another reason why initiatives like school composting programs can yield dividends beyond the diverted materials in the long run.

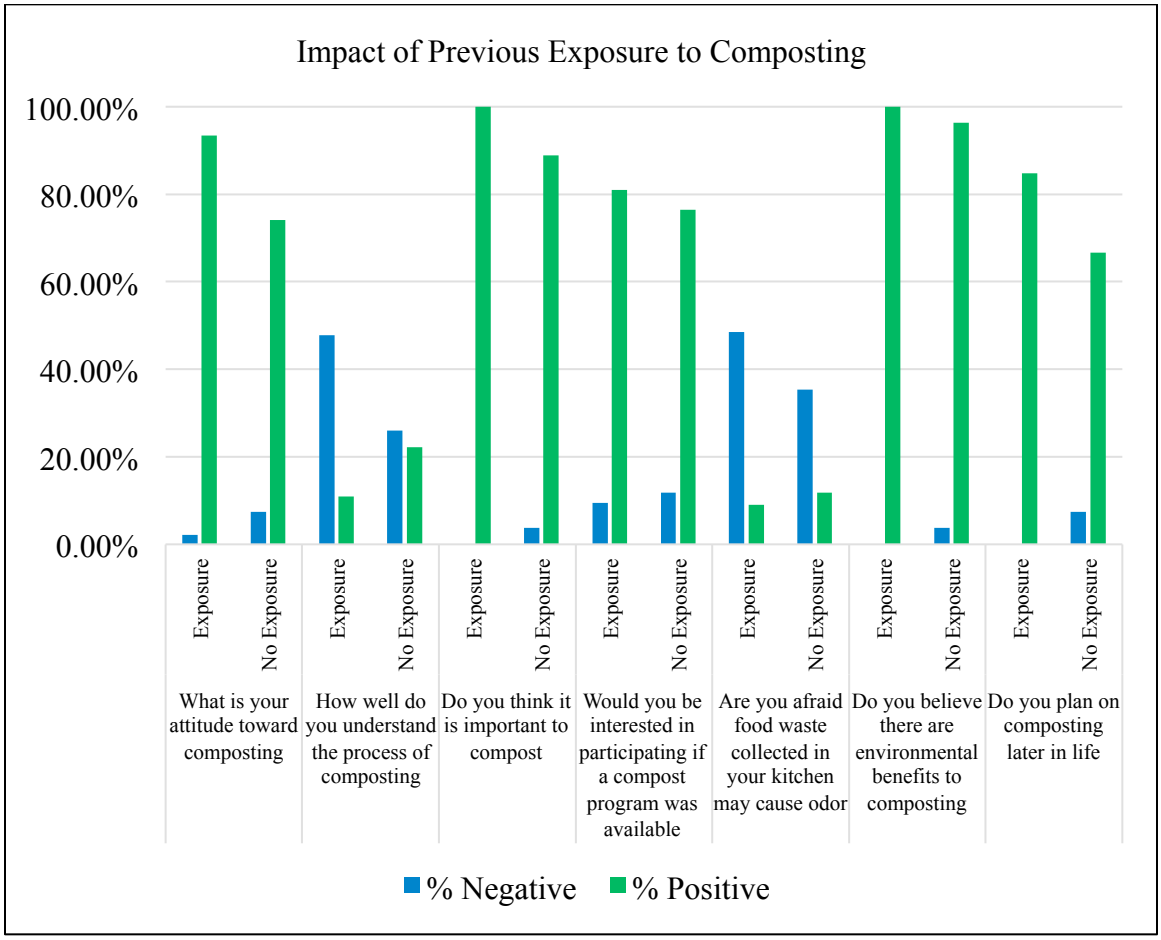


Figure 5: Graph of Ordinal Analysis of Participant Informational Responses grouped by experience composting

## Impact of Gender

It was hypothesized that the gender of the student would not be a significant predictor of composting behavior, because most literature on composting behavior did not examine the role of gender and sustainability. However, one study explored the relationship between sustainability initiatives and gender composition of corporate boards. The study found that boards with greater gender diversity were most likely to initiate sustainability strategies. Additional findings discussed how women may be more supportive of environmental practices in general; however, women CEOs are no more likely to advance innovative environmental policies than men CEOs (Glass et. al., 2015).

Figure 6 shows male versus female attitudes toward composting. According to Figure 6 female participants were more confident in their understanding of what could and could not be composted. This may have resulted from more female participants reading the flyer on compostable material (Appendix B, Table 3). However, responses yielded no relevant statistically significant results when doing parametric analysis. Given that this stratification had the largest sample sizes, this is a telling result that the men and women taking this survey think similarly about composting; or, that we cannot confirm they have different views scientifically.

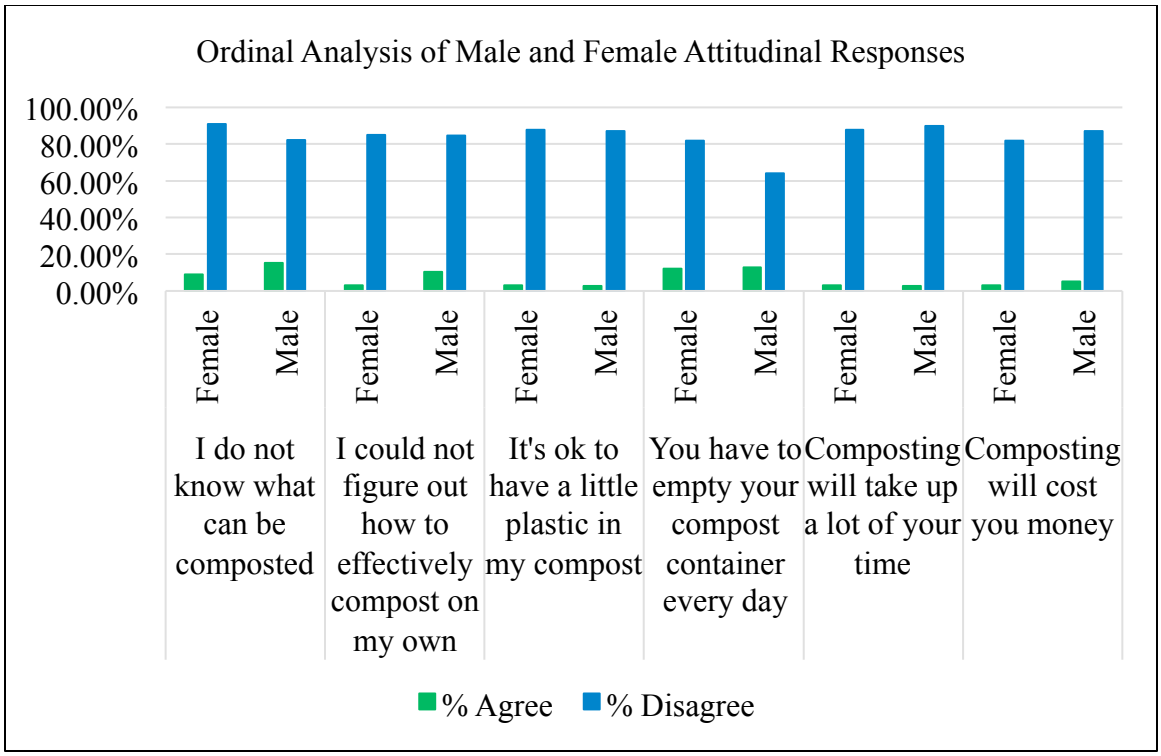

Figure 6: Graph of Ordinal Analysis of Male and Female Attitudinal Responses

Figure 7 shows males' versus females' responses for informational questions about composting using Top-Box analysis. Even without statistically significant differences, we can still learn from their responses. According to Figure 7, both male and female participants expressed a predominantly positive attitude toward composting and belief in the importance of composting. In addition both groups had similar responses to understanding the process of composting, which indicates neither gender is more or less familiar with the process.

Female participants were likely to be more concerned about odor caused by composting; when asked if compost causes odors, 52 percent of female participants agreed while 38 percent of male participants agreed (Appendix B, Table 4). This belief may have be correlated to their responses about not wanting to empty the compost container on a daily basis, or their higher confidence that they could properly execute

composting may mean a more realistic view of the potential for odors. It may also have been rooted in the idea that women would be less likely to tolerate a smelly apartment and show greater willingness to prevent that possibility. According to survey results women were slightly more likely to disagree that the compost container should be emptied on a daily basis. Even though there were no statistically significant difference between males and females attitudes and informational views about composting, females were more likely to respond strongly about their attitudes towards composting, yet responded less positively about their ability to effectively compost.

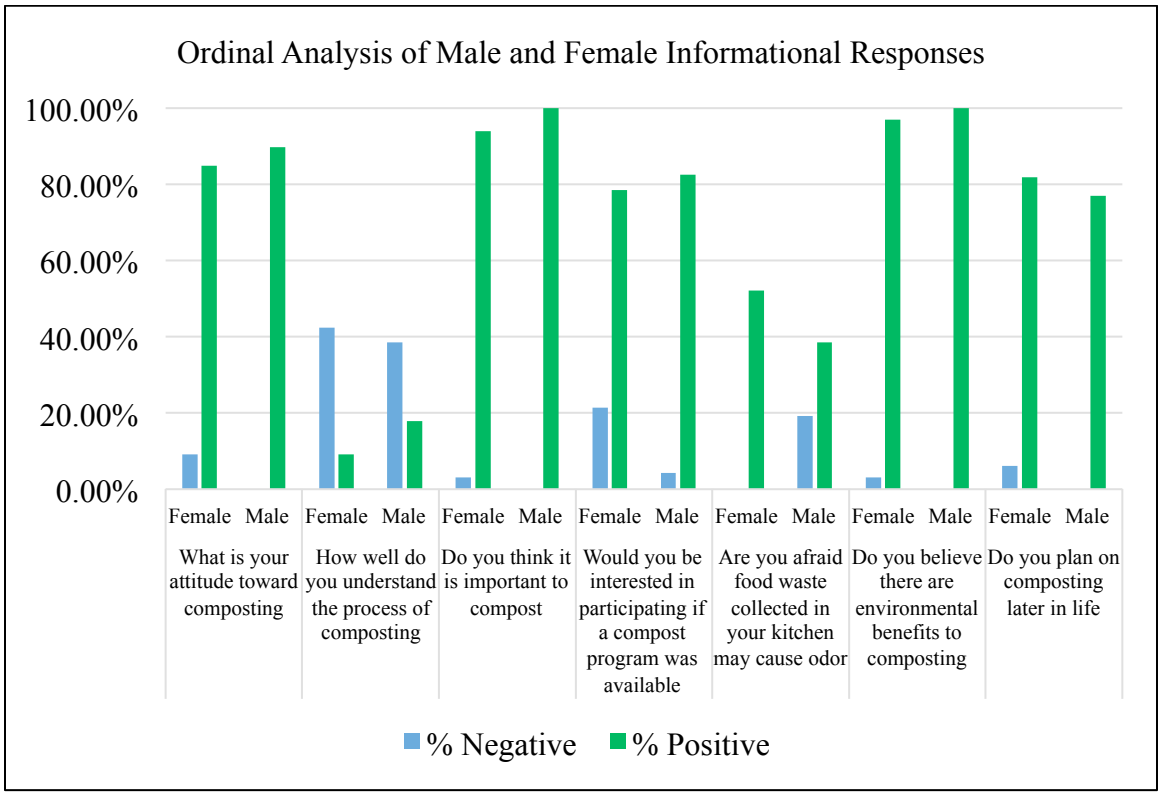


Figure 7: Graph of Ordinal Analysis of Male and Female Informational Responses

## Impact of Participants Hometown

It was hypothesized that the location of where a participant grew up would be a significant factor of composting attitude. Figure 8 grouped participants by where they were raised and compares their perceptions of composting. The groupings of location where raised were: 1) central and northern Maine; 2) southern Maine; and 3) outside Maine. As mentioned previously, there were initially eight separate locations students could choose from. To create relatively equal sized groups the central, northern, and western Maine groups were pooled along with the other New England states and other.

It was hypothesized that where a participant grew up would be a significant factor of composting attitude because students who grew up in a more rural environment would be assumed to be more likely to have experience composting. Many of the "From Away" respondents were from Massachusetts and were assumed to have grown up in more urban areas with less experience composting. One can assume that the average student from central and northern Maine would have grown up in a more rural community on average than either the southern Maine or outside Maine groups. According to Figure 8 participants who grew up in northern and central Maine were more confident in their understanding of what material is compostable and their ability to compost on their own. Students from northern and central Maine might be more confident than their peers from southern Maine and other states because they have experience composting at home in their backyards and are more likely to be from farming communities. Students from southern Maine and out-of-state may have not engaged in composting before due to several barriers created by living in urban communities.

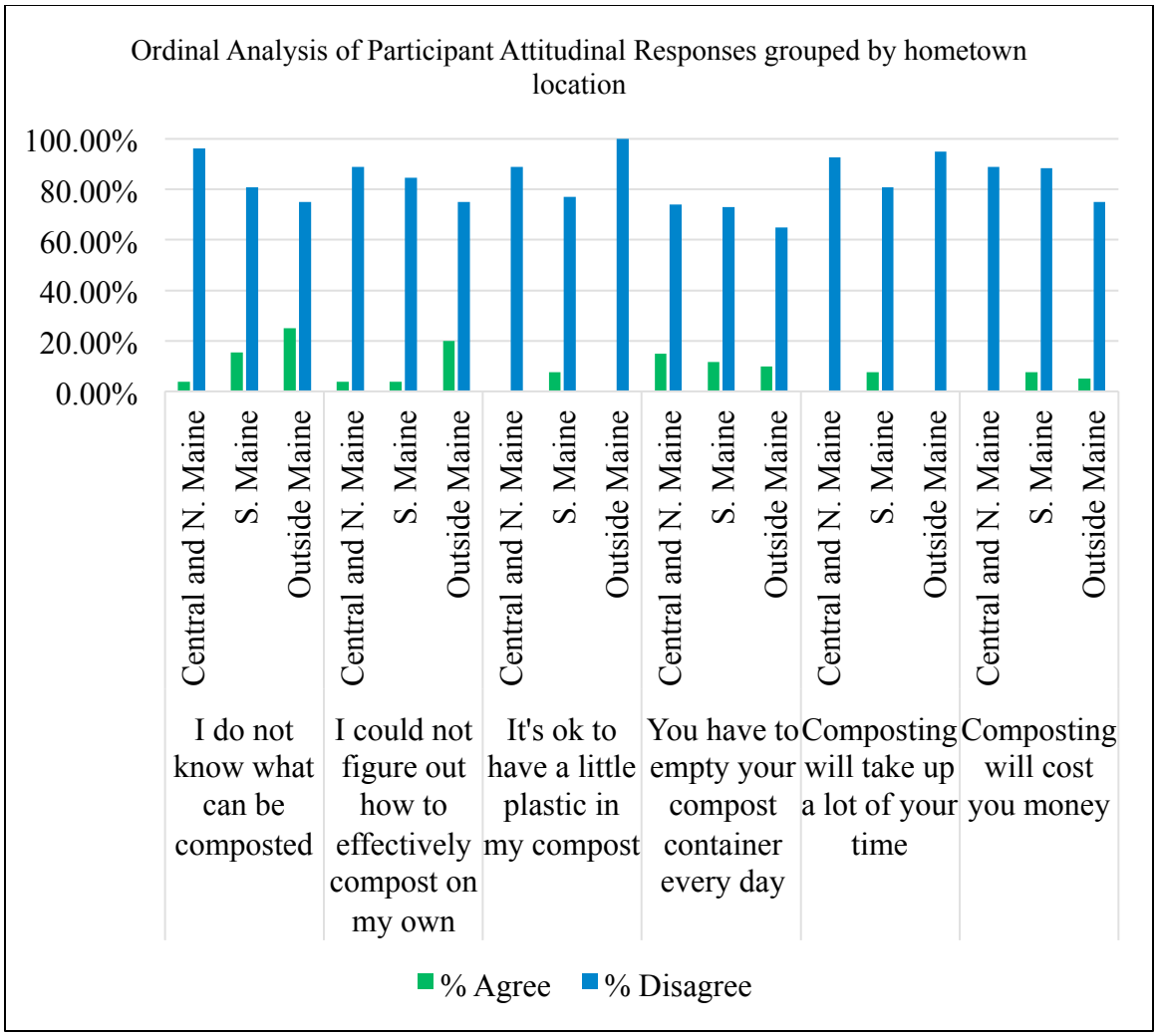


Figure 8: Graph of Ordinal Analysis of Participant Attitudinal Responses grouped by hometown location: Central and Northern Maine, Southern Maine, and Outside Maine

According to Figure 9 participants in each grouping had a positive attitude toward composting, belief in the importance of composting, and understanding of environmental benefits of composting. Participants did differ in their response to wanting to participate in a composting program if it was made available. Participants from southern Maine were most interested in participating while participants from outside Maine were least interested. When asked, would you be interested in participating if a composting program was available, 90 percent of participants from southern Maine responded positively while only 70 percent of participants from out of state responded positively (Appendix B, Table

6). This may suggest that participants from outside Maine have less familiarity with composting and are therefore less interested in becoming involved in such a program or have lesser motivations towards such a program. This also reflects the growing number of Maine organics companies which presently concentrated in Southern Maine. This survey says that's a good idea! They want it, but due to urban living have significant barriers which the service providers can help them overcome.

According to Figure 9 participants from outside Maine had the lowest concern towards odor. When asked, are you afraid food waste collected in your kitchen may cause odor, 53.3 percent of participants from out of state responded they were not compared to 35 percent of southern Maine participants, and 46.7 percent of central and northern Maine participants (Appendix B, Table 6). This suggests participants from out of state were at least aware of the odor caused by composting, since the participants with the greatest experience composting were more concerned about the odor. According to Table 6 groups mirror responses' current intention and future actions toward composting. Participants from Southern Maine were most interested in composting currently and in the future. This suggests people are not putting off a sustainable behavior, and want to do it now and in the future.

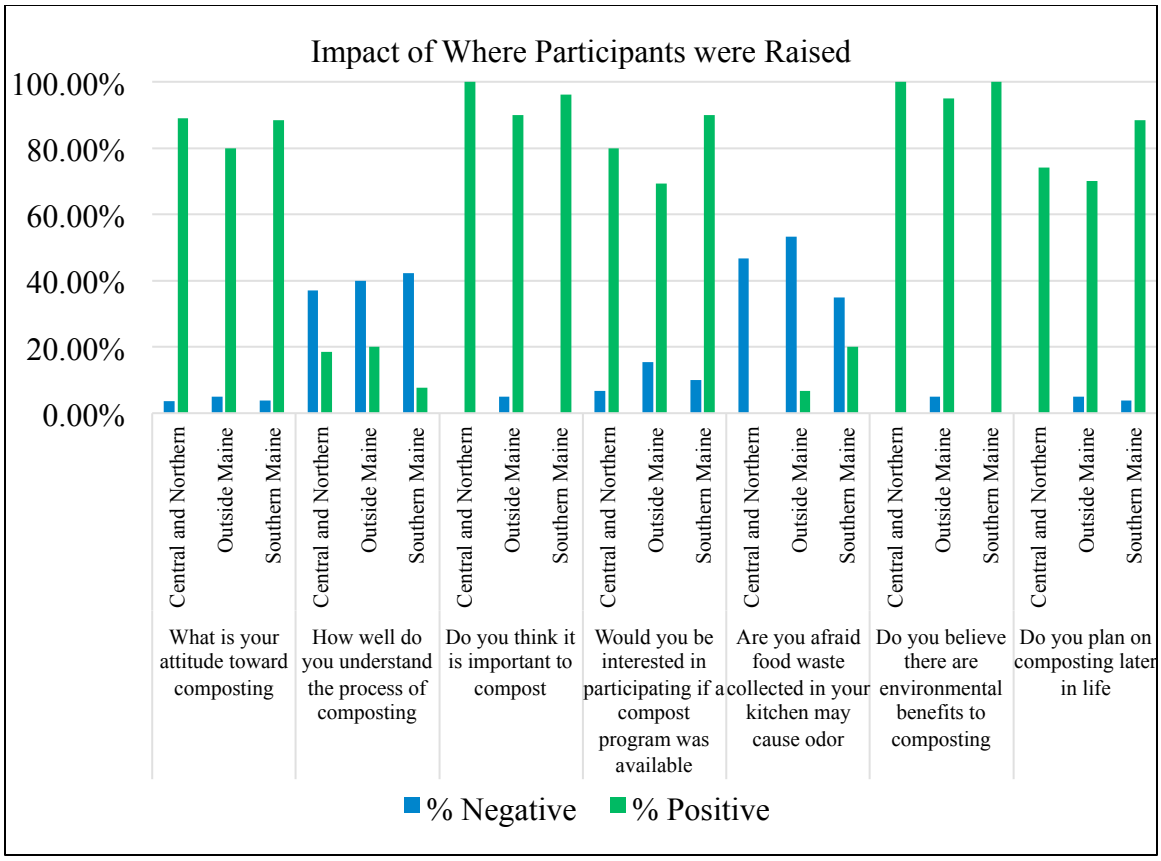

Figure 9: Graph of Ordinal Analysis of Participant Informational Responses grouped by hometown location: Central and Northern Maine, Southern Maine, and Outside Maine

## Impact of Participants Year in School

The academic year of the student was hypothesized to be an insignificant factor in predicting composting behavior. The academic year was predicted to not influence composting behavior because previous studies related the behavior to beliefs not age among this age demographic. According to Figure 10 students in their sophomore year of college were more confident in their ability to compost. Sophomores had the lowest percent of respondents who agreed to the statement "I do not know what can be composted" and "I could not figure out how to effectively compost on my own." This suggests participants in their sophomore year may have had previous exposure to composting or have a different attitude toward the practice when compared to juniors and

seniors. There may also be some naivety about what composting may entail as this is likely the first experience any of the sophomore students had with extensively cooking for themselves. Juniors and seniors are more likely to have lived outside of traditional dorms and therefore have dealt with an odorous kitchen garbage bag and understand that food scraps will eventually smell.

Seniors were more likely to disagree with "having some plastic in compost is ok" than juniors and sophomores. This suggests the seniors were more likely to have read the flyer that was distributed at the beginning of the fall semester which stated that non-biodegradable product are not allowed in the composting bins or that they have been exposed to this information through classes, popular media, etc... Seniors and juniors were also more likely to disagree with the statement composting will cost you money than sophomores were. This may suggest sophomores have had more experience with programs that you pay to have your compost removed. In southern Maine in particular, composting programs are growing exponentially so the younger students are more likely to have participated in one of those monthly subscription programs. They also may believe that you can throw money at a problem such as odor and make it go away! Investing in specialized kitchen bins with replaceable charcoal filters is one way to reduce odor if that is a goal. As exposure levels increase we should expect to see more-informed opinions and great understanding about how to best manage the food scraps in their apartment.

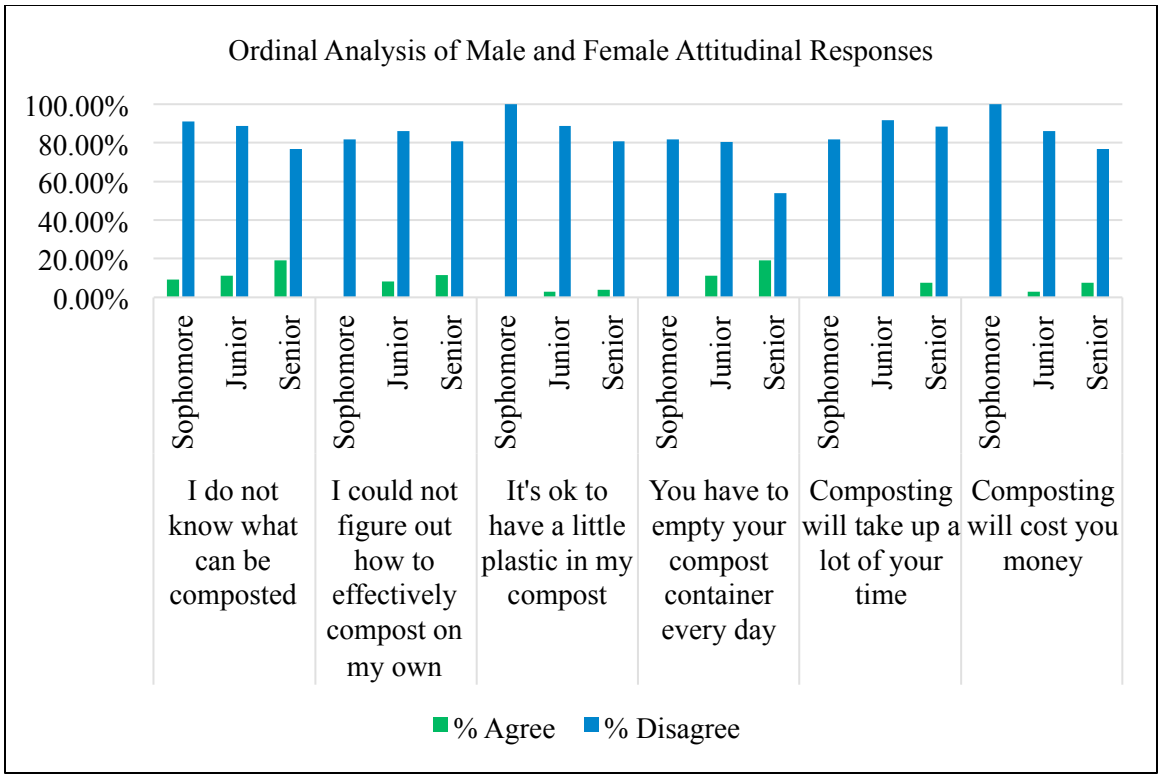

Figure 10: Graph of Ordinal Analysis of Participants Attitudinal Responses grouped by year in school

Figure 11 shows the responses to informational questions by what year in college the respondent was. The majority of participants in all groups had a positive attitude toward composting, importance of composting, and belief in environmental benefits of composting. However, sophomore participants responded least positively to wanting to participate in a composting program if it was made available and wanting to compost later in life. This may be due to a lack familiarity with composting or a short-term view of "the rest of their life" as it may seem infinitely far away as compared to someone who is graduating soon. The only respondents who did not disagree that there were environmental benefits to composting were sophomores. Seniors were the only group to not have any responses stating that they were afraid that composting would cause odors. This may be due to experience with composting, managing kitchen scraps, or a lack of sensitivity to common odors that they now are aware of and deal with. Juniors tended to

have slightly more positive views about composting than seniors. There are many possible reasons for this, but this may be due to the seniors misinterpreting the questions to think about long-term views of composting at UMaine only, instead of a more general view of composting for the rest of their life.

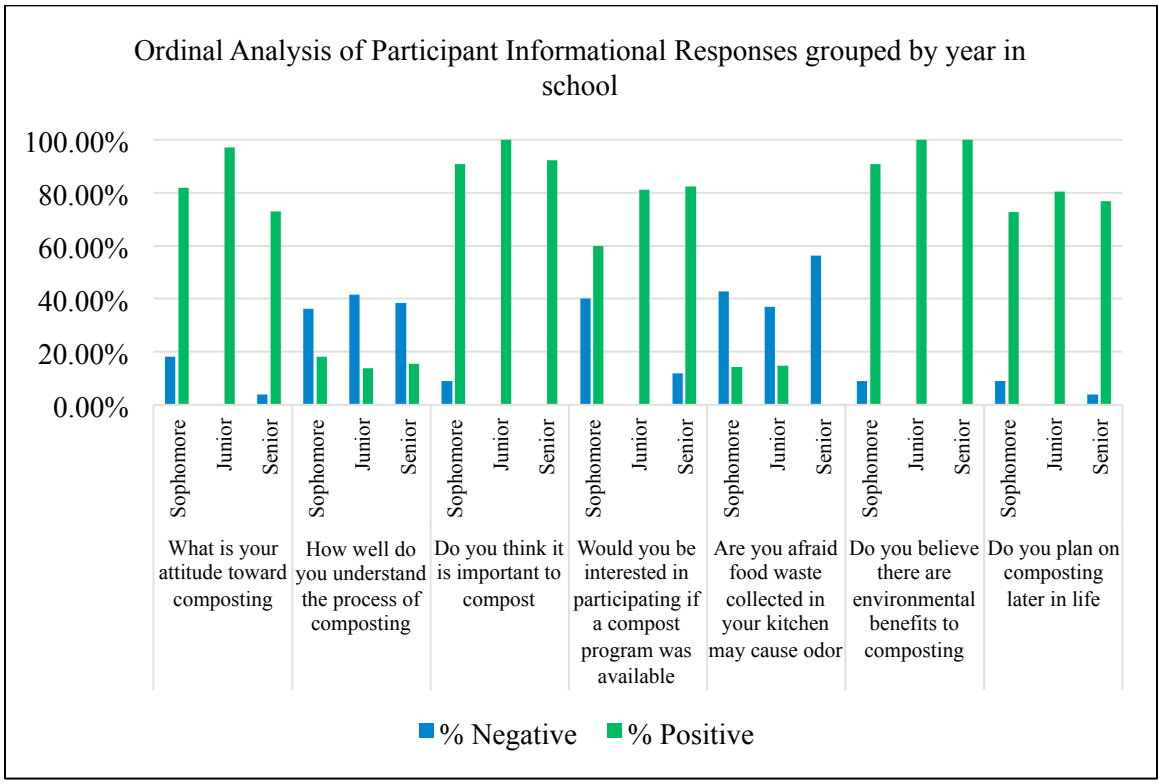


Figure 11: Graph of Ordinal Analysis of Participant Informational Responses grouped by year in school

## Changes in Student Responses in the Pre and Post-Survey

There were seven students who I was able to link their pre and post survey results. The student's interest in participating in a composting program increased in two of the participants, and decreased in two of the participants. The interest in composting in the future shifted from somewhat positive to extremely positive in two participants. However, two other participants shifted from extremely positive to somewhat negative. This may have been due to a variety of reasons, for instance, the participants may have

been surprised by the odor caused by composting or having to sort their waste products into an additional container. Another problem I ran into personally at the beginning of the fall semester was the compost bin attracting fruit flies. Speculating, students who are afraid of or do not like insects may have had a bigger problem with this issue.

Another finding was that several students who participated in the composting program shifted their opinions on having to empty the bin every day. One student shifted from disagreeing to strongly agreeing, while another shifted from somewhat agree to disagree, and two students shifted from somewhat disagree to neutral.

The students who answered the survey with identifiers that could be matched to survey results provided valuable information on how this program can be improved in the future. It is clear that students were very interested in participating in the composting program. However, students with no previous experience with composting were not aware of the odors and fruit flies caused by collecting food scraps nor with how to reduce them. In order to better prepare students it would have been beneficial to have a training or floor meeting about composting. This would have served to increase participation and aide students in determining best practices for collecting food scraps.

# DISCUSSION

In this study two on-campus apartments at the University of Maine served as a model of how collaborative efforts between students, faculty, and administration can significantly reduce food waste in apartment housing. All universities, regardless of size, type, or location can take a leading role in improving society's management of organic materials through educating students and providing them with access to the programs that can teach them the sustainable behaviors they can continue for the rest of their lives. This study also demonstrated potential barriers to student composting practices through implementation of an on campus composting program at the University of Maine. College is a learning experience. This applies to both students' programs of study, and also for their lives. Whether it be learning how to pay their rent on time, balance the demands of work, family, school, and friends, or becoming exposed to activities that enhance society's sustainability, their time at an institution of higher learning is vital to molding their long-term actions. The goal of this study was to show what impact a pilot program such as ours could have on student behavior, attitudes, and future intentions, as well as, lead to extended research on this topic at The University of Maine.

It was hypothesized that the implementation of an on-campus apartment composting program would result in significant food waste diversion. The total waste diverted for the fall semester was 642.2 lbs. This was a significant improvement compared to previous years when no organic waste was diverted by students living in the on-campus apartments, in addition, this gave students the opportunity to practice a more sustainable lifestyle. The total mass of organic waste diverted also demonstrates that

many students were actively involved in the program and had an interest in practicing this sustainable behavior. However, it is difficult to tell how many students participated and whether a larger amount of organic waste should have been expected to be diverted. A barrier to gaining greater student participation in this program may have been the lack of access to student emails and the inability to track whether or not students were aware of the program altogether. At the beginning of the school year emails were collected but not all students were available, which may have limited the number of participants. Bulk emails are easily ignored and therefore hard to truly assess the total number of students that knowingly did or did not participate. This study may have been improved by working more closely with the Resident Assistants of the on-campus apartments to encourage students to participate, and making it a part of the apartment complex's opening meetings. Having a flier already in the apartment prior to move in day may have encouraged more students to participate.

Overall, this project met all of the initial objectives; waste was diverted, university students were encouraged to compost, and students practiced an eco-friendly behavior. However, after completing this project there is still more that can be done. This program would have been more successful with greater support from Resident Assistants. It was also difficult to calculate how much compostable material should have been collected. It may have been useful to know how many students had meal plans and how many students did not. Students may have also been more inclined to participate in the program if they all had had some type of exposure to composting in the past. This could be achieved by collecting post-consumer compostable material in dining halls.

It was hypothesized that where a participant grew up would be a significant factor of composting attitude. The reasoning for this hypothesis was students raised in rural environments would be more likely to have experience composting. Students from southern Maine had very positive feelings toward composting. This suggests urban Mainers are also passionate about the environment and want to live sustainably when possible.

It was assumed that many of the out of state respondents were from Massachusetts and were more likely to have grown up in urban or suburban areas where there are significant barriers to composting. Participants raised in northern and central Maine responded more confidently in their understanding of what material is compostable and ability to compost on their own. This finding shows that the groups least likely to want to compost are those from out of state who lack familiarity with the process. One of the barriers to starting a new program is gaining interest from participants who lack experience. Overcoming that barrier was a goal of this program. As students venture out into the world they now can carry their experience with them. Engaging in backyard composting, signing up for an organics management subscription, or taking advantage of a town operated program are now hopefully more likely to occur now for those students who participated in this program.

Another hypothesis was that a participant's exposure to composting in the past would be a significant factor in predicting attitude toward composting. Participants who had composted in the past were more confident in their ability to compost and their understanding of what material could be composted. These findings suggest individuals who have experience with a practice are more confident in their understanding of the

topic and ability. This means that students who participated in this composting program for the first time this school year are more likely to want to continue composting. It also means that this pilot program may be more successful next year with several students who have already participated and have an interest in composting.

Participants who had experience composting were also more likely to agree that they had a positive attitude toward composting. This suggests a barrier to increasing composting behavior on campus is the lack of overall exposure to this behavior. Wherever the University can, it should create programs and structures where students have the opportunity to take part in composting programs in their dorm, cafeteria, or at special events throughout the year across campus. Through doing this, a greater number of students will have a positive attitude toward composting and be more likely to engage in composting behavior. This also means that students who participated in the composting program this year will be more likely to want to participate next year.

## Limitations

Some limitations may have affected the research study's results. The lack of first year students represented in the data does not accurately represent the entirety of the undergraduate student population at the University of Maine. We are missing a critical component of the student maturation process, which in many cases, may cause the largest changes in attitudes, behaviors, and perceptions. The optional unique identifier used by students in the pre-test only matched for seven respondents making drawing strong inferences from that aspect of the data difficult. Given more ability to collect contact information (i.e. emails), we would have been able to effectively track the students and

also encourage them to retake the survey in the spring semester. The overall sample size was low due to limited access to students living on-campus with access to this composting program. Due to the low sample size and inability to match up pre- and post-test surveys, all responses from the fall and spring semesters were analyzed together. The ability to look comprehensively at the differences between the pre- and post-survey for large pooled groups of students was a goal of this project. Another limitation was the inability to compare University of Maine student housing to other forms of housing (i.e. private apartments, fraternities, and sororities). This study was unable to compare the different housing options because there were not enough participants to compare due to the "small pools" and lack of sampling private apartments, university housing, etc. This data would have been useful to have a bigger picture of all students attending the University of Maine.

## Conclusions

After thorough discussion of student responses, several conclusions can be made. The University of Maine, as the state's flagship university, would benefit from offering more programs that enable students to practice environmentally conscious and sustainable behaviors. By providing students with the opportunity to learn and engage in environmental health programs on campus, the university can use their impact as a model for the surrounding community and society as a whole. Composting is a great example of such a behavior and there are numerous models for how this can be incorporated throughout UMaine's campus. The University of Maine's undergraduate students surveyed have positive feelings and attitudes towards composting and sustained interest

in practicing environmentally conscious behaviors. The positive perception of composting that students expressed can be expanded into change within the university community. It is recommended to expand composting to post-consumer food scraps within university dining halls to involve all individuals on campus in environmentally sustainable practices. This will lead to greater student exposure to sustainable practices. If students beginning in their freshman year were able to compost their food scraps at the dining halls, the majority of students would some level of exposure to composting. This would result in a greater number of students having a positive attitude of composting and desire to continue composting in the future as they leave the University setting.

## Suggestions for further research

Further research is needed on the short-term and long-term effects of a university-wide campaign to reduce organic waste production and disposal. Additionally, students may benefit from additional educational programs regarding sustainability. It is recommended that future studies examine students' attitudes towards composting in dining halls. We also must understand the risks associated with expanding the program to all students (contaminants, odor, etc.) and create solutions to these possible problems that are proactive and comprehensive. By studying students' attitudes towards composting at the start of their college career it may be easier to gain participation in on-campus apartment composting efforts. Creating a culture where it is not "new" or "unique" to compost at Patch/DTAV or elsewhere across campus takes time and consistent availability of the program. I am hopeful that my project will continue next year with an additional student leading the charge for composting in the apartment complex. In light of

the student experiences and difficulty in gaining survey responses, there are some discernable actions that can be taken to improve the program.

1. Coordinate with Housing Services and the RAs to include training for this program in the orientation for the RAs at Patch and DTAV.
2. Start promoting the program on move-in day with flyers and outreach.
3. Spend additional time attempting to connect with more residents early in the semester one-on-one to discuss the composting program and recruit more participants.
4. Have workshops throughout the semester (with treats!) to have a forum for students to discuss their experiences and crowd source solutions to common problems.
5. Offer students containers with lids to collect compost in and to reduce odors
6. Improve survey to gather additional information regarding students' behaviors. Ask students how many meals they prepared weekly. Ask students if they participated in the compost program and for how long. Allow students to provide additional feedback at end of survey to determine how to further improve the program.

In conclusion, environmental health issues are important to ensure the planet's health and maintain a sustainable ecosystem to live in. Through the reduction of waste and reuse of materials, natural resources are conserved. Individuals can become a part of the process and promote environmentally healthy choices in their lives, communities, and the world.

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# APPENDICES

## APPENDIX A

*(KEEP THIS PAGE AS ONE PAGE – DO NOT CHANGE MARGINS/FONTS!!!!!!!!!)*

**APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS**
**Protection of Human Subjects Review Board, 418 Corbett Hall, 581-1498**

(Type inside gray areas)
PRINCIPAL INVESTIGATOR: Travis Blackmer
EMAIL: travis.blackmer@maine.edu TELEPHONE: 1-3155
CO-INVESTIGATOR(S): Sierra Kunn
FACULTY SPONSOR (Required if PI is a student):
TITLE OF PROJECT: Organics Program Survey

START DATE: 8/29 PI DEPARTMENT: Mitchell Center/Economics
MAILING ADDRESS: 200c Winslow Hall
FUNDING AGENCY (if any): Margaret Chase Smith Policy Center (for UMaine portion)
STATUS OF PI:
FACULTY/STAFF/GRADUATE/UNDERGRADUATE

1. If PI is a student, is this research to be performed:

☐ for an honors thesis/senior thesis/capstone? ☐ for a master's thesis?
☐ for a doctoral dissertation? ☐ for a course project?
☐ other (specify)

2. Does this application modify a previously approved project? N (Y/N). If yes, please give assigned number (if known) of previously approved project:

3. Is an expedited review requested? Y (Y/N).

Submitting the application indicates the principal investigator's agreement to abide by the responsibilities outlined in Section I.E. of the Policies and Procedures for the Protection of Human Subjects.

Faculty Sponsors are responsible for oversight of research conducted by their students. The Faculty Sponsor ensures that he/she has read the application and that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research. REMINDER: If the principal investigator is an undergraduate student, the Faculty Sponsor MUST submit the application to the IRB.

**Email complete application to Gayle Jones (gayle.jones@umit.maine.edu)**

**********

FOR IRB USE ONLY Application # 2016-08-06 Date received 08/08/2016 Review (F/E): E
Expedited Category:

ACTION TAKEN:

X Judged Exempt; category 1&2 Modifications required? Y Accepted (date) 8/29/2016
☐ Approved as submitted. Date of next review: by Degree of Risk:
☐ Approved pending modifications. Date of next review: by Degree of Risk:
Modifications accepted (date):
☐ Not approved (see attached statement)
☐ Judged not research with human subjects

FINAL APPROVAL TO BEGIN 8/29/2016
Date

04/2016

# APPENDIX B

Table 1: Ordinal Analysis of Participant Attitudinal Responses grouped by experience composting

| Question | Group | % Agree | % Disagree |
|---|---|---|---|
| I do not know what can be composted | No Exposure | 18.52% | 77.78% |
| | Exposure | 10.87% | 89.13% |
| I could not figure out how to effectively compost on my own | No Exposure | 18.52% | 74.07% |
| | Exposure | 2.17% | 89.13% |
| It's ok to have a little plastic in my compost | No Exposure | 0.00% | 88.89% |
| | Exposure | 4.35% | 86.96% |
| You have to empty your compost container every day | No Exposure | 11.11% | 62.96% |
| | Exposure | 13.04% | 76.09% |
| Composting will take up a lot of your time | No Exposure | 3.70% | 88.89% |
| | Exposure | 2.17% | 89.13% |
| Composting will cost you money | No Exposure | 3.70% | 77.78% |
| | Exposure | 4.35% | 89.13% |

Table 2: Ordinal Analysis of Participant Informational Responses grouped by experience composting

| Descriptives | Group | % Negative | % Positive |
|---|---|---|---|
| What is your attitude toward composting | Exposure | 2.17% | 93.48% |
| | No Exposure | 7.41% | 74.07% |
| How well do you understand the process of composting | Exposure | 47.83% | 10.87% |
| | No Exposure | 25.93% | 22.22% |
| Do you think it is important to compost | Exposure | 0.00% | 100.00% |
| | No Exposure | 3.70% | 88.89% |
| Would you be interested in participating if a compost program was available | Exposure | 9.52% | 80.95% |
| | No Exposure | 11.76% | 76.47% |
| Are you afraid food waste collected in your kitchen may cause odor | Exposure | 48.48% | 9.09% |
| | No Exposure | 35.29% | 11.76% |
| Do you believe there are environmental benefits to composting | Exposure | 0.00% | 100.00% |
| | No Exposure | 3.70% | 96.30% |
| Do you plan on composting later in life | Exposure | 0.00% | 84.78% |
| | No Exposure | 7.41% | 66.67% |

Table 3: Ordinal Analysis of Male and Female Attitudinal Responses

| Question | Group | % Agree | % Disagree |
|---|---|---|---|
| I do not know what can be composted | Female | 9.09% | 90.91% |
| | Male | 15.38% | 82.05% |
| I could not figure out how to effectively compost on my own | Female | 3.03% | 84.85% |
| | Male | 10.26% | 84.62% |
| It's ok to have a little plastic in my compost | Female | 3.03% | 87.88% |
| | Male | 2.56% | 87.18% |
| You have to empty your compost container every day | Female | 12.12% | 81.82% |
| | Male | 12.82% | 64.10% |
| Composting will take up a lot of your time | Female | 3.03% | 87.88% |
| | Male | 2.56% | 89.74% |
| Composting will cost you money | Female | 3.03% | 81.82% |
| | Male | 5.13% | 87.18% |

Table 4: Ordinal Analysis of Male and Female Informational Responses

| Question | Group | % Negative | % Positive |
|---|---|---|---|
| What is your attitude toward composting | Female | 9.09% | 84.85% |
| | Male | 0.00% | 89.74% |
| How well do you understand the process of composting | Female | 42.42% | 9.09% |
| | Male | 38.46% | 17.95% |
| Do you think it is important to compost | Female | 3.03% | 93.94% |
| | Male | 0.00% | 100.00% |
| Would you be interested in participating if a compost program was available | Female | 21.43% | 78.57% |
| | Male | 4.35% | 82.61% |
| Are you afraid food waste collected in your kitchen may cause odor | Female | 0.00% | 52.17% |
| | Male | 19.23% | 38.46% |
| Do you believe there are environmental benefits to composting | Female | 3.03% | 96.97% |
| | Male | 0.00% | 100.00% |
| Do you plan on composting later in life | Female | 6.06% | 81.82% |
| | Male | 0.00% | 76.92% |

Table 5: Ordinal Analysis of Participant Attitudinal Responses grouped by hometown location: Central and Northern Maine, Southern Maine, and Outside Maine

| Question | Group | % Agree | % Disagree |
|---|---|---|---|
| I do not know what can be composted | Central and N. Maine | 3.70% | 96.30% |
| | S. Maine | 15.38% | 80.77% |
| | Outside Maine | 25.00% | 75.00% |
| I could not figure out how to effectively compost on my own | Central and N. Maine | 3.70% | 88.89% |
| | S. Maine | 3.85% | 84.62% |
| | Outside Maine | 20.00% | 75.00% |
| It's ok to have a little plastic in my compost | Central and N. Maine | 0.00% | 88.89% |
| | S. Maine | 7.69% | 76.92% |
| | Outside Maine | 0.00% | 100.00% |
| You have to empty your compost container every day | Central and N. Maine | 14.81% | 74.07% |
| | S. Maine | 11.54% | 73.08% |
| | Outside Maine | 10.00% | 65.00% |
| Composting will take up a lot of your time | Central and N. Maine | 0.00% | 92.59% |
| | S. Maine | 7.69% | 80.77% |
| | Outside Maine | 0.00% | 95.00% |
| Composting will cost you money | Central and N. Maine | 0.00% | 88.89% |
| | S. Maine | 7.69% | 88.46% |
| | Outside Maine | 5.00% | 75.00% |

Table 6: Ordinal Analysis of Participant Informational Responses grouped by hometown location: Central and Northern Maine, Southern Maine, and Outside Maine

| Question | Group | % Negative | % Positive |
|---|---|---|---|
| What is your attitude toward composting | Central and N. Maine | 3.70% | 88.89% |
| | Outside Maine | 5.00% | 80.00% |
| | S. Maine | 3.85% | 88.46% |
| How well do you understand the process of composting | Central and N. Maine | 37.04% | 18.52% |
| | Outside Maine | 40.00% | 20.00% |
| | S. Maine | 42.31% | 7.69% |
| Do you think it is important to compost | Central and N. Maine | 0.00% | 100.00% |
| | Outside Maine | 5.00% | 90.00% |
| | S. Maine | 0.00% | 96.15% |
| Would you be interested in participating if a compost program was available | Central and N. Maine | 6.67% | 80.00% |
| | Outside Maine | 15.38% | 69.23% |
| | S. Maine | 10.00% | 90.00% |
| Are you afraid food waste collected in your kitchen may cause odor | Central and N. Maine | 46.67% | 0.00% |
| | Outside Maine | 53.33% | 6.67% |
| | S. Maine | 35.00% | 20.00% |
| Do you believe there are environmental benefits to composting | Central and N. Maine | 0.00% | 100.00% |
| | Outside Maine | 5.00% | 95.00% |
| | S. Maine | 0.00% | 100.00% |
| Do you plan on composting later in life | Central and N. Maine | 0.00% | 74.07% |
| | Outside Maine | 5.00% | 70.00% |
| | S. Maine | 3.85% | 88.46% |

Table 7: Ordinal Analysis of Participants Attitudinal Responses grouped by year in school

| Question | Group | % Agree | % Disagree |
|---|---|---|---|
| I do not know what can be composted | Sophomore | 9.09% | 90.91% |
| | Junior | 11.11% | 88.89% |
| | Senior | 19.23% | 76.92% |
| I could not figure out how to effectively compost on my own | Sophomore | 0.00% | 81.82% |
| | Junior | 8.33% | 86.11% |
| | Senior | 11.54% | 80.77% |
| It's ok to have a little plastic in my compost | Sophomore | 0.00% | 100.00% |
| | Junior | 2.78% | 88.89% |
| | Senior | 3.85% | 80.77% |
| You have to empty your compost container every day | Sophomore | 0.00% | 81.82% |
| | Junior | 11.11% | 80.56% |
| | Senior | 19.23% | 53.85% |
| Composting will take up a lot of your time | Sophomore | 0.00% | 81.82% |
| | Junior | 0.00% | 91.67% |
| | Senior | 7.69% | 88.46% |
| Composting will cost you money | Sophomore | 0.00% | 100.00% |
| | Junior | 2.78% | 86.11% |
| | Senior | 7.69% | 76.92% |

Table 10: Ordinal Analysis of Participant Informational Responses grouped by year in school

| Question | Group | % Negative | % Positive |
|---|---|---|---|
| What is your attitude toward composting | Sophomore | 18.18% | 81.82% |
| | Junior | 0.00% | 97.22% |
| | Senior | 3.85% | 73.08% |
| How well do you understand the process of composting | Sophomore | 36.36% | 18.18% |
| | Junior | 41.67% | 13.89% |
| | Senior | 38.46% | 15.38% |
| Do you think it is important to compost | Sophomore | 9.09% | 90.91% |
| | Junior | 0.00% | 100.00% |
| | Senior | 0.00% | 92.31% |
| Would you be interested in participating if a compost program was available | Sophomore | 40.00% | 60.00% |
| | Junior | 0.00% | 81.25% |
| | Senior | 11.76% | 82.35% |
| Are you afraid food waste collected in your kitchen may cause odor | Sophomore | 42.86% | 14.29% |
| | Junior | 37.04% | 14.81% |
| | Senior | 56.25% | 0.00% |
| Do you believe there are environmental benefits to composting | Sophomore | 9.09% | 90.91% |
| | Junior | 0.00% | 100.00% |
| | Senior | 0.00% | 100.00% |
| Do you plan on composting later in life | Sophomore | 9.09% | 72.73% |
| | Junior | 0.00% | 80.56% |
| | Senior | 3.85% | 76.92% |

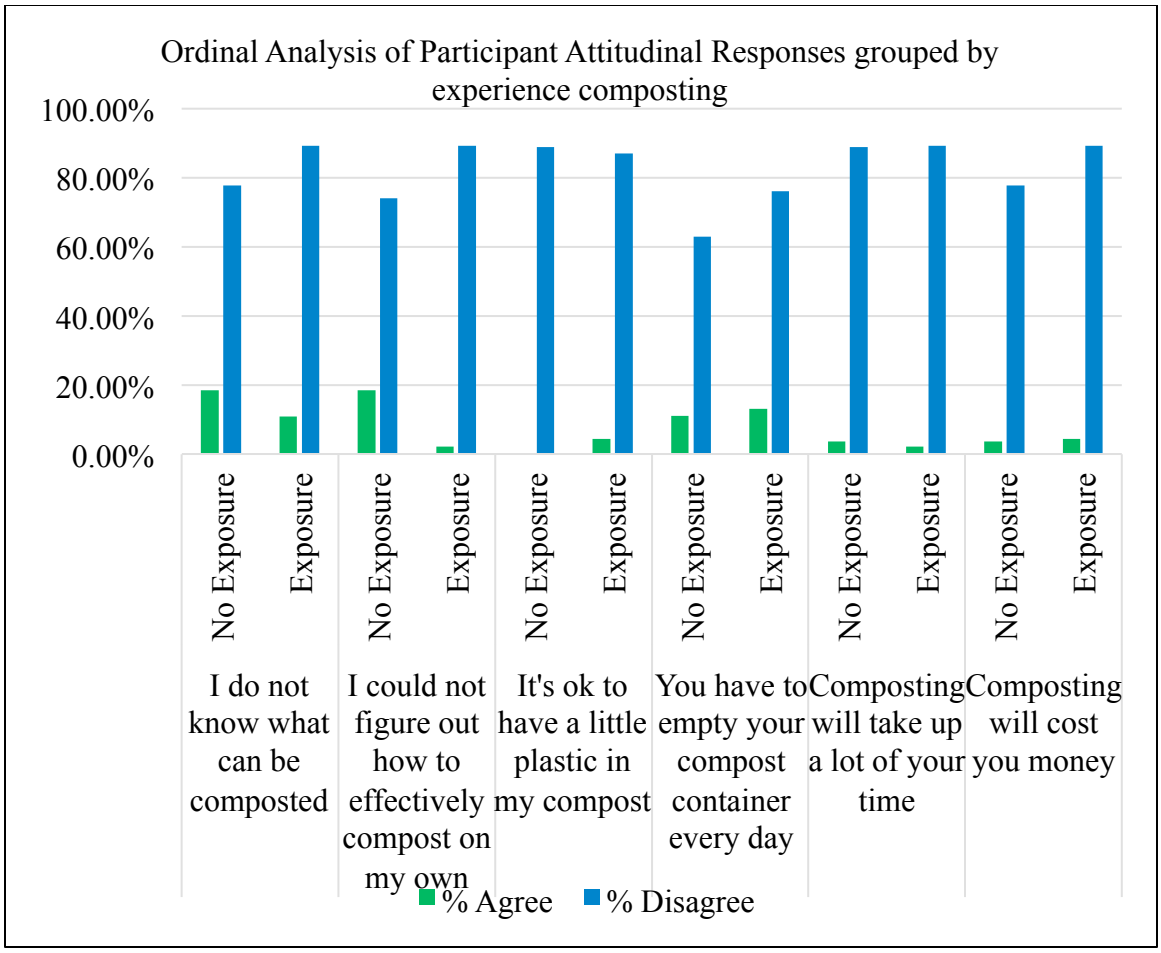


Figure 1: Graph of Ordinal Analysis of Participant Attitudinal Responses grouped by experience composting

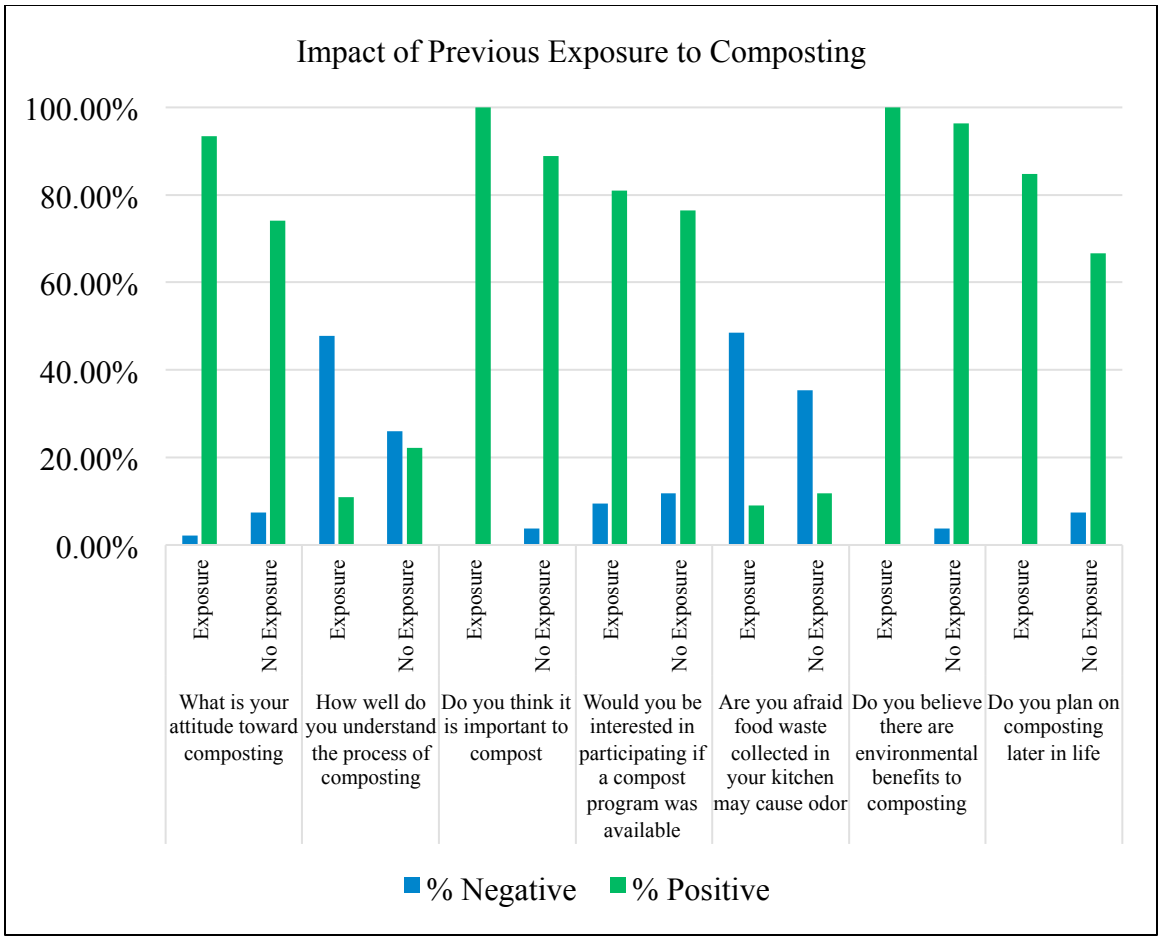


Figure 2: Graph of Ordinal Analysis of Participant Informational Responses grouped by experience composting

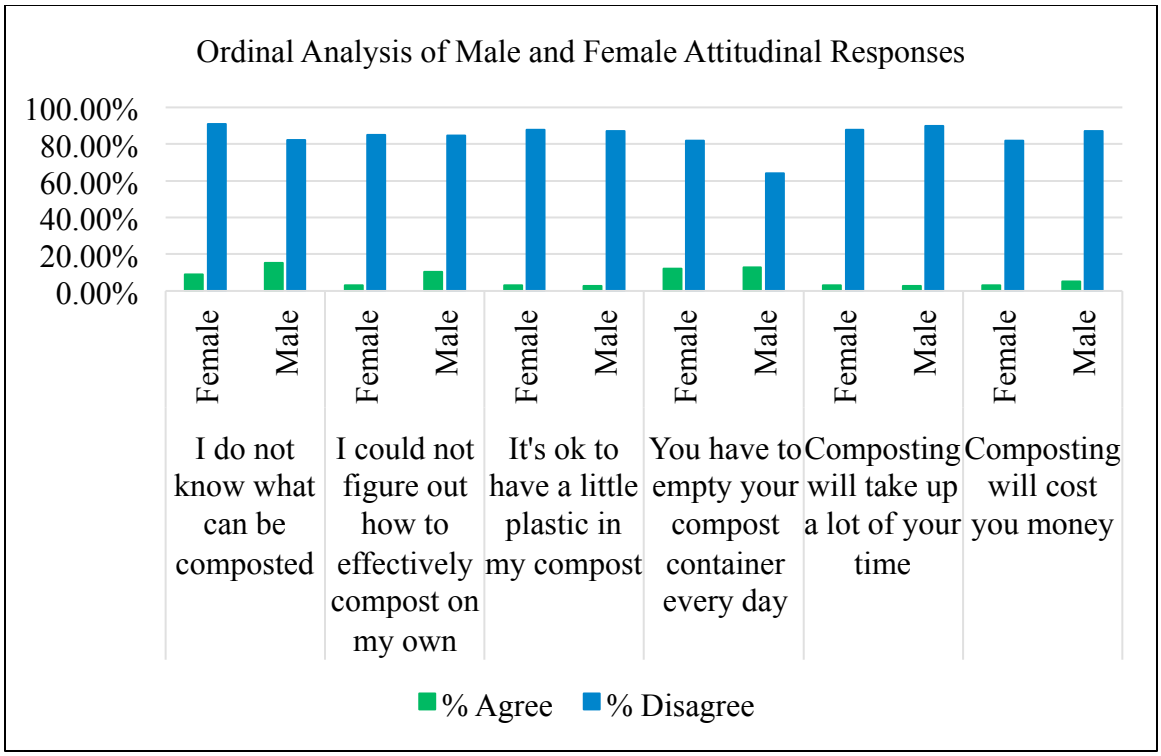


Figure 3: Graph of Ordinal Analysis of Male and Female Attitudinal Responses

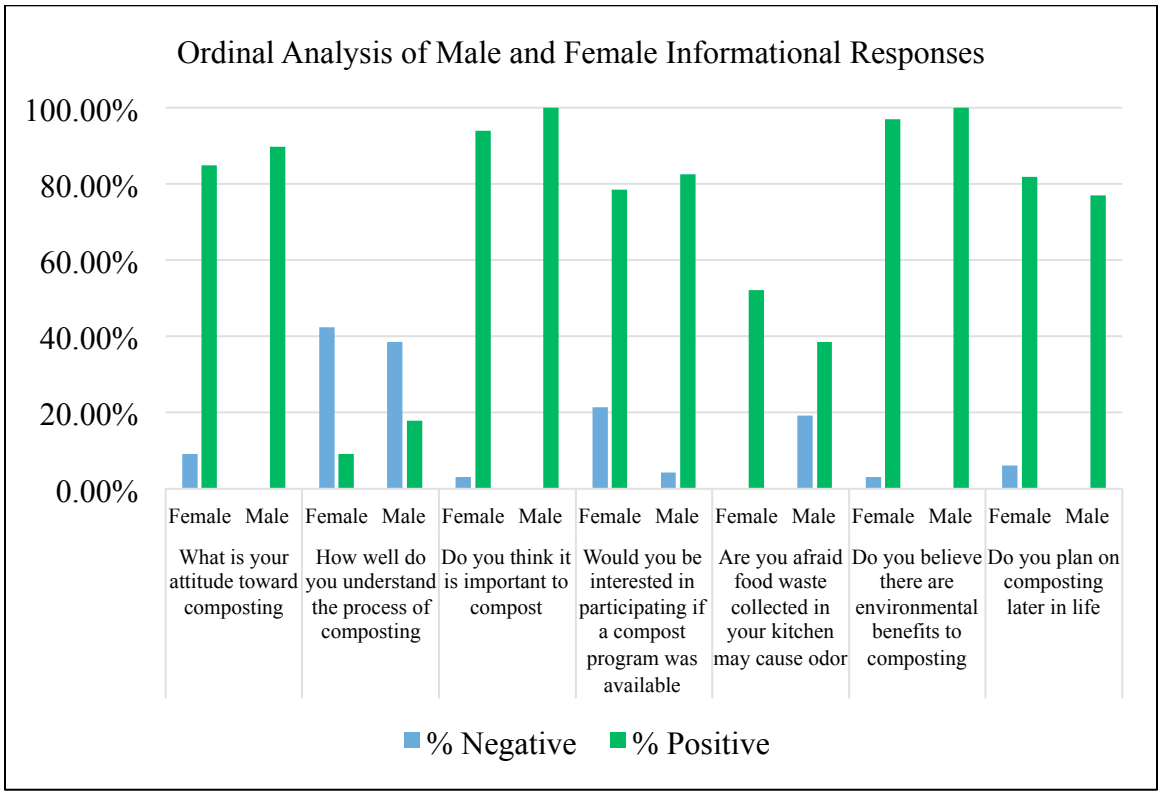


Figure 4: Graph of Ordinal Analysis of Male and Female Informational Responses

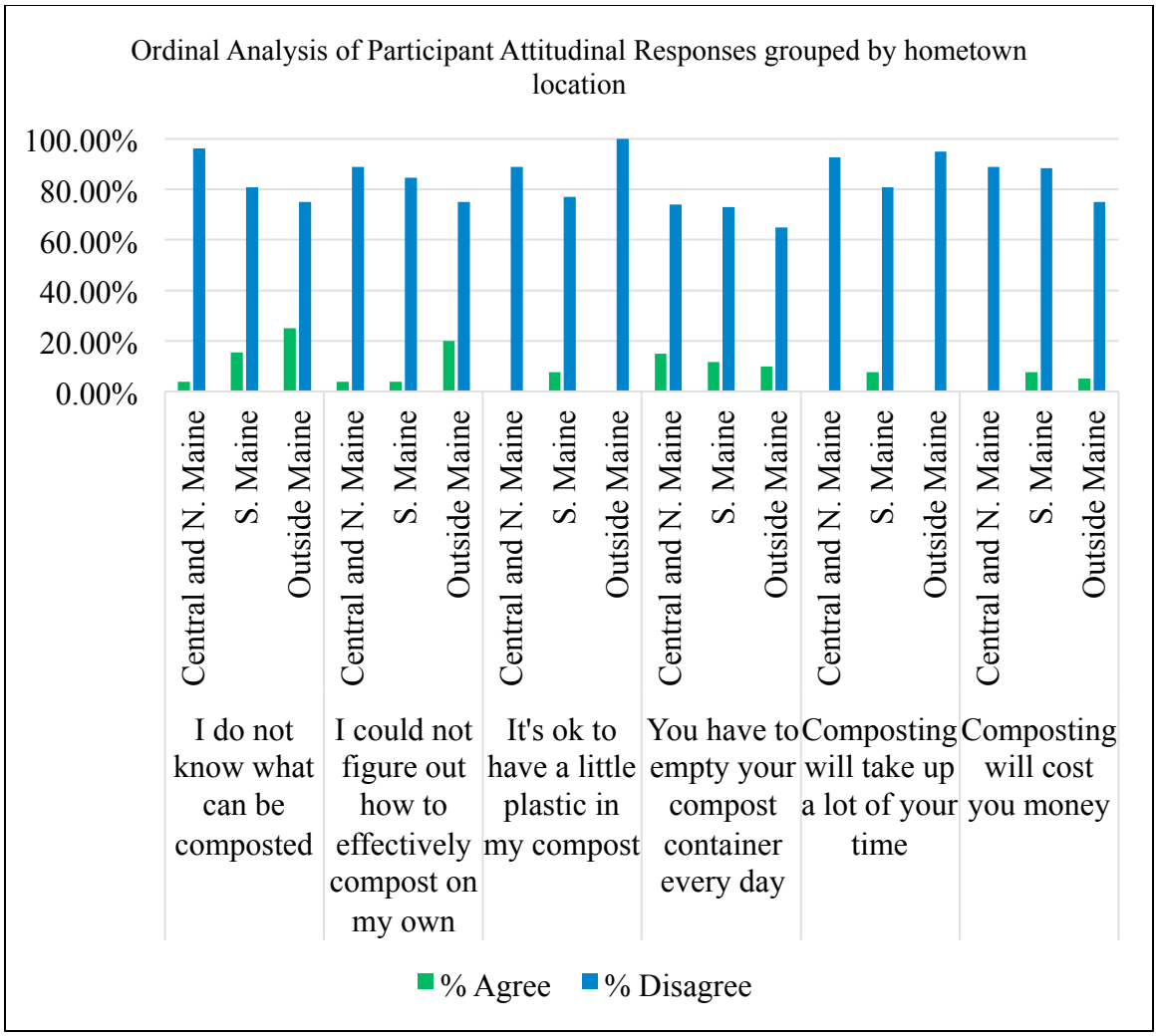


Figure 5: Graph of Ordinal Analysis of Participant Attitudinal Responses grouped by hometown location: Central and Northern Maine, Southern Maine, and Outside Maine

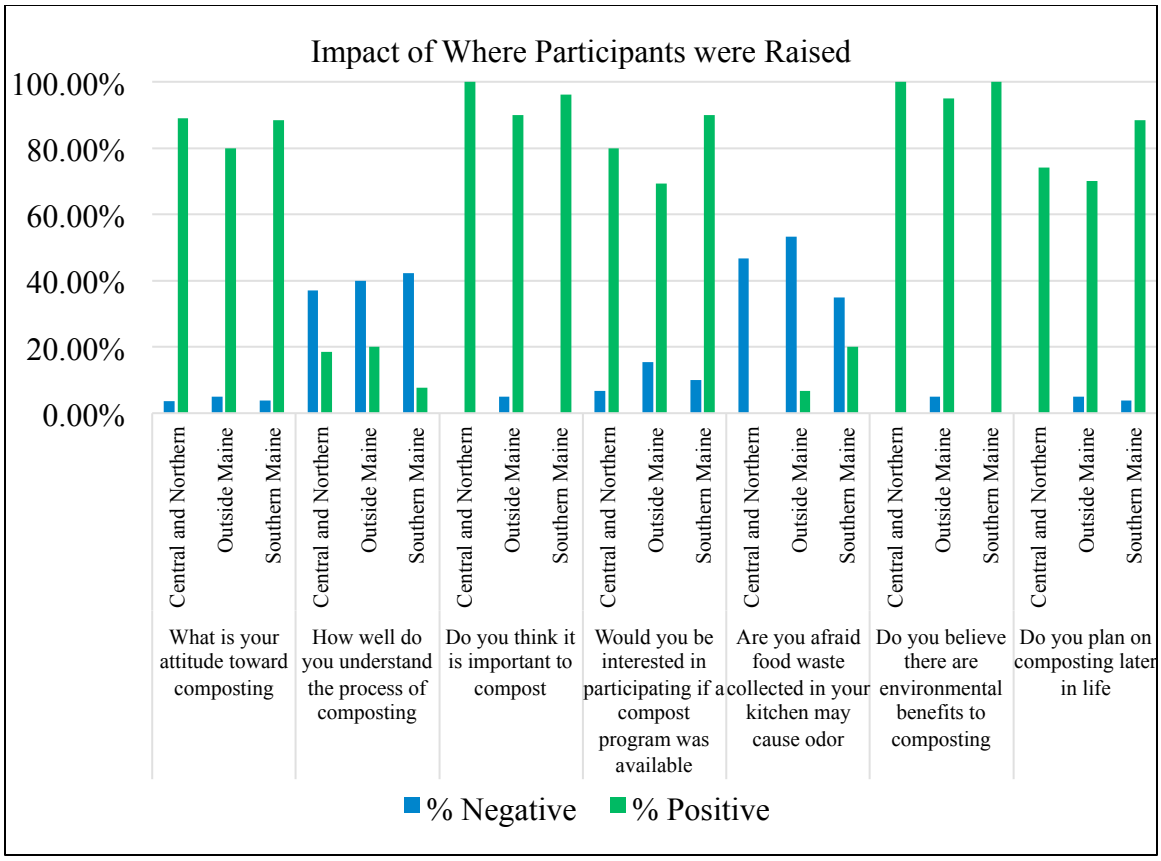

Figure 6: Graph of Ordinal Analysis of Participant Informational Responses grouped by hometown location: Central and Northern Maine, Southern Maine, and Outside Maine

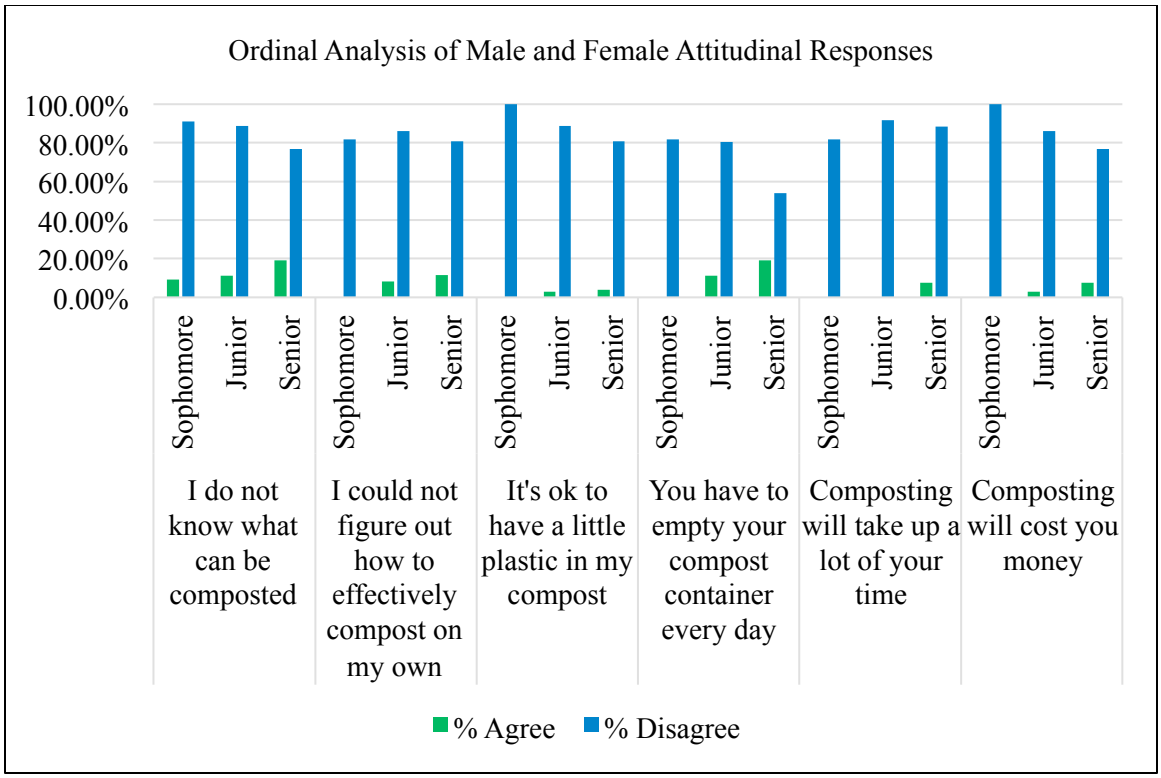


Figure 7: Graph of Ordinal Analysis of Participants Attitudinal Responses grouped by year in school

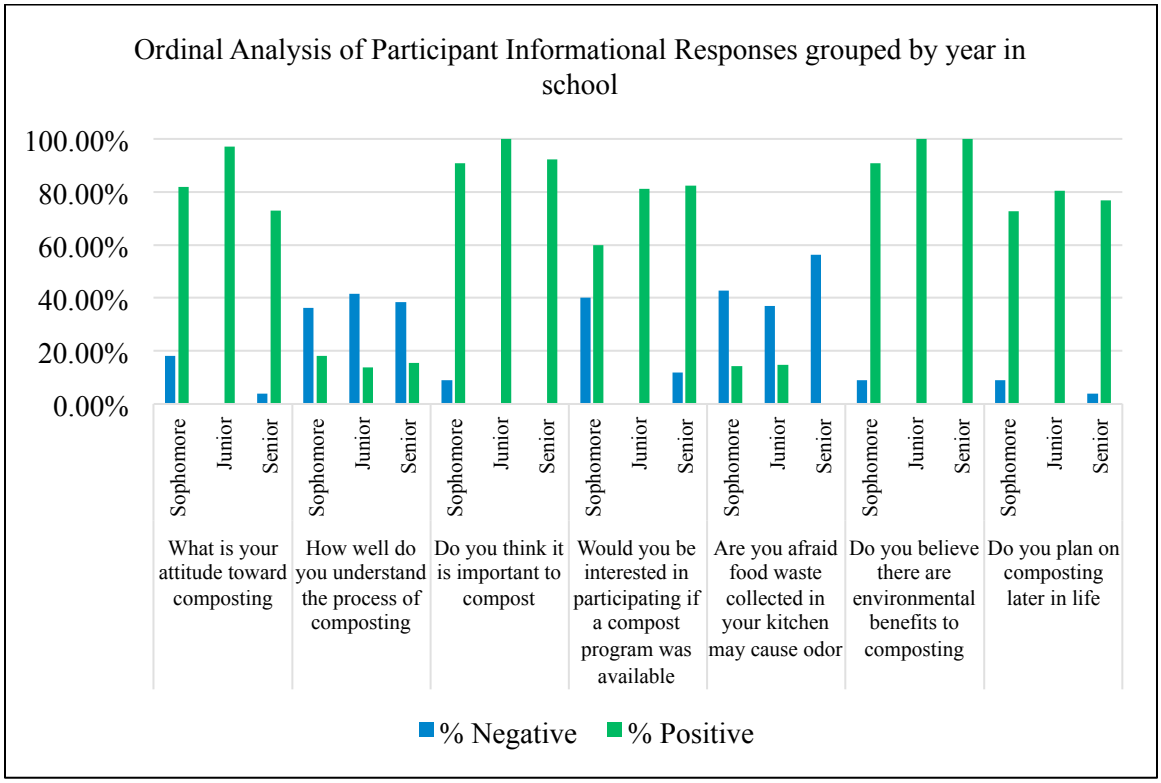


Figure 8: Graph of Ordinal Analysis of Participant Informational Responses grouped by year in school

BIOGRAPHY

Sierra C. Kuun was born on December 1, 1994. She was raised in Kennebunkport, Maine and graduated from Kennebunk High School in 2013. Sierra is a senior Chemical Engineering student at the University of Maine and part of the Honors College. She is the vice president of Maine College Democrats and involved with Engineers without Borders, UMaine's chapter of the American Institute of Chemical Engineers, and UMaine's chapter of the Technical Association of the Pulp and Paper Industry. She has spent her summers during college interning at Rachel Carson Wildlife Refuge, the Maine NEW Leadership Program, and SAPPI. During the school year Sierra has served as a Maine Learning Assistant tutoring students in general chemistry, worked at the Margaret Chase Smith Policy Center, and interned at the Senator George J. Mitchell Center as part of the Waste Management team. Sierra received the Margaret Chase Smith Public Affairs Scholarship, Pulp and Paper Foundation Scholarship, and is a Senator George J. Mitchell Scholar. Sierra looks forward to beginning her engineering career this summer at Enterprise Engineering, Inc. located in Falmouth, Maine.