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An investigation of on-campus composting among undergraduate college students

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An Investigation of On-campus Composting Among Undergraduate College Students

An Honors Program Project Presented to
the Faculty of the Undergraduate
College of Health and Behavioral Studies
James Madison University

by Ashleigh Beben

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Accepted by the faculty of the Department of Health Sciences, James Madison University, in partial fulfillment of the requirements for the Honors Program.

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PUBLIC PRESENTATION

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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 dining halls. Questionnaires containing questions related to composting behavior and knowledge, demographics, and place of residence were distributed to 140 James Madison University (JMU) undergraduate students. Of those students 26.4% were males and 73.6% were females. Freshmen made up 77.9% of the sample followed by sophomores making up 14.3% of respondents. The sample was made up of 80 people in the control group and 60 in the experimental group. Both groups were given the pre-test questionnaire in person and emailed the post-test questionnaire via Qualtrics. Only the experimental group was presented a brief educational PowerPoint presentation pertaining to composting and received the first post-test questionnaire to account for immediate changes. Statistical significance identified relationships for the stages of change, self-efficacy, and attitude test scores among the experimental group. Overall the experimental group showed more improvement from pre-test to post-test scores on composting information and composted more often. Most respondents fell within the maintenance or action stages of change. This study has shown the potential that universities have in mobilizing students to take action in promoting environmentally healthy choices. Further research should involve observing the short-term and long-term effects of a campaign to reduce waste production on-campus.

Chapter 1: Introduction

Composting

Composting is the process of decomposition of organic materials that occurs when the temperature, carbon-nitrogen ratio, water, oxygen flow, and particle size are controlled to create a stable material to balance the soil's flora and fight pathogens and weeds (EPA, 2014a; Addison, n.d.). Composting allows for the collection of organic materials and wastes to be decomposed naturally to create a nutrient rich amendment of soil (EPA, 2014a). One benefit of composting is keeping communities and our environment clean by essentially isolating food wastes in a confined area to reduce the amount of waste brought to landfills (EPA, 2014b). Composting has many environmental impacts which include the reduction of using fertilizers to produce more agricultural output, restoring wetlands and other destroyed land areas, removing hazardous wastes from air and runoff water, allowing more space to be used in landfills and circumventing the formulation of methane and leachate in landfills (EPA, 2014a).

Soil health

Soil health can be improved through composting because organic materials can provide a storage location for water and nutrients that plants will use to flourish and grow (Beetz, 2002). Soil is made up of many different components, which include minerals, organic matter and some living species of micro-organisms (Soyoye & Ademosun, 2014). The strength of the soil helps support plant life and allows for the recycling of nutrients to occur (Soyoye & Ademosun, 2014). Bacteria in the soil can break down certain elements and minerals that may be contained in organic matter found in the soil, therefore they are the most abundant organisms found in the soil with each functioning in a unique way to help create nutrient-rich topsoil (Beetz, 2002). Furthermore, composting provides soil maintenance for any soil that is lacking richness and can

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help amend them into once again nutrient-rich sources for plants to use for development (Addison, n.d.).

Food Waste

Keeping food wastes out of landfills and incinerators is beneficial to the environment and can be replaced by the more natural process of composting (Saer, Lansing, Davitt, & Graves, 2013). The waste in the landfill sits for years as materials go through a natural and slow decomposition process (Capitol Regional District, 2014). Landfills are used to collect solid waste and have many federal and state regulations to keep them running properly without causing contamination of water and surrounding areas (EPA, 2014c). The second greatest constituent of municipal solid waste generated by humans was food waste (Saer, Lansing, Davitt, & Graves, 2013). The food waste alternatively being composted is a sustainable replacement for landfill and incineration use (Saer, Lansing, Davitt, & Graves, 2013).

The University Setting

Communities, such as academic universities and higher education institutions, produce a large quantity of waste on a daily basis (Bartlett, 2011). A college campus has potential to create environmental sustainability projects because of their size and influence on surrounding populations (Barlett, 2011).

College campuses are at the forefront for new innovations to reduce consumption and waste and become models for the communities around them all across the country (Babich & Smith, 2010). Through their research, Babich and Smith (2010) observed on-campus dining halls could make the most improvements by reducing the amount of water used for cooking and generating less food waste. Many universities have become a part of the American College and University Presidents Climate Commitment (ACUPCC) to make more sustainable decisions for

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the environment and reduce waste materials (Bartlett, 2011). Natural resources can be protected and land can be used more effectively through the promotion of environmental sustainability on college campuses (Alshuwaikhat & Abubakar, 2008).

Campuses can become more sustainable through student participation along with contribution from the faculty and the administration to create new policies in dining halls at universities (Bartlett, 2011). One example could be recycling more often in the correct receptacles and properly composting food wastes (Baldwin & Dripps, 2012). Higher education institutions should integrate learning and awareness of environmental health benefits associated with food projects on campus (Bartlett, 2011). A study in Ontario found that 21.6 percent of the University of Northern British Columbia's campus waste was made up of organic compostable material (Smyth, Fredeen & Booth, 2010). That waste could have been minimized by students, therefore reducing the price of on-campus meals and lessening their environmental footprint (Babich & Smith, 2010). Their environmental footprint could also be reduced by using less energy in dining halls to prepare meals for students (Babich & Smith, 2010).

Social marketing can also be useful in assembling students to make a positive change in their community among their peers (Bartlett, 2011). Many universities are working with different organizations to provide social responsibility to the community on environmental concerns and information necessary for sustainable living (Alshuwaikhat & Abubakar, 2008). It is even proposed that universities could be most successful at becoming "green" if the involvement of a large portion of students occurs through the institution's education of conservation of resources, climate change and the preservation of the environment (Alshuwaikhat & Abubakar, 2008).

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Composting is a necessary waste process to many ecosystems. A focus on changing attitudes and the knowledge base of university students concerning on-campus composting is a way to allow surrounding communities to implement that process.

Chapter 2: Review of Literature

Environmental Programs

The literature of sustainability and initiatives on college campuses pertaining to composting and other environmental activities will be discussed.

The reduction of solid waste through composting and recycling can provide universities with sustainability programs to create a cleaner environment. Babich and Smith (2010) researched the sustainability of on-campus dining halls at Southern Illinois University, while Smyth, Freedon and Booth (2010) researched the University of British Columbia's (UNBC) management of waste on campus. Within those studies, the researchers attempted to identify ways the university could create more environmentally friendly policies at their dining halls and improve sustainability processes on-campus (Babich & Smith, 2010; Smyth et al., 2010). Compostable organic materials tend to cost the most money to dispose of, so universities should mobilize students to participate in diverting waste from landfills and using the material for an on-campus composting program (Smyth et al., 2010). The exact amount of food should be prepared once the amount of people dining in that day are quantified to avoid throwing away excess food (Babich & Smith, 2010). The studies offered ways that universities can begin making their campuses more sustainable and promoting waste minimization practices in the university setting (Babich & Smith, 2010; Smyth et al., 2010). Composting in dining halls on-campus at James Madison University (JMU) is a good example of a university promoting sustainability and waste reduction.

Sustainability programs implemented on university campuses can make a difference in surrounding communities. Bartlett (2011) provided an anthropological critique of on-campus sustainability projects in furthering the improvement of using alternative food systems among

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universities. Bartlett (2011) found that many universities were increasingly purchasing more sustainable food products from local farms, which allowed more financial stability and competition between food service corporations. Buying locally grown produce and meat allowed for less fuel to be spent transporting food to the universities, which recouped money for other expenditures. Also the worldview of sustainability may be hard to change without the proper support for environmental programs (Bartlett, 2011). The shift to sustainability among different communities can only be possible by readjusting norms among the population (Bartlett, 2011). A long-term change is necessary for properly implementing sustainability programs, which is a capability of college campuses (Bartlett, 2011). Through political support and the building of coalitions in the community, campus food projects can be made possible (Bartlett, 2011). Mobilization of individuals within the community encourages sustainability programs to be implemented, which could be the role found among JMU students, faculty, and staff to promote composting efforts in dining halls.

Students' thoughts and knowledge about college sustainability programs, which encompassed composting, recycling and other waste reduction processes, were considered by Emanuel and Adams (2011). This study provided a framework for exploring students' perceptions of recycling or composting on their college campus, which could be useful in guiding the information that may be necessary for those to make a behavior change. Emanuel and Adams (2011) found that all students believed in making more environmental efforts on their campus (Emanuel & Adams, 2011). The researchers concluded that the administration at any college should create sustainable programs, separate from state-run programs to allow for greater change and students should become aware and involved in those programs (Emanuel & Adams,

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2011). Awareness of environmental projects on-campus and knowing student perceptions toward them can be beneficial within the college community in promotion of those projects.

Theory

The development of the Transtheoretical Model (TTM) of Behavior Change has allowed researchers to measure people's levels of readiness to make a health behavior change (Prochaska & DiClemente, 1984). The constructs that make up the theory include the stages of change, the processes of change, decisional balance and self-efficacy (Prochaska et. al, 1994). The stages of change are made up of precontemplation, contemplation, preparation, action, and maintenance (Prochaska et. al, 1994). Precontemplation is the stage in which the individual is not thinking about making a behavior change within the following six months (Prochaska et. al, 1994). Contemplation is when the individual is seriously thinking about making a behavior change within the next six months (Prochaska et. al, 1994). Preparation is the stage when the individual has tried to make a behavior change in the past six months and failed, but is seriously thinking about making the behavior change within the next month (Prochaska et. al, 1994). Action is the time when the individual has made a behavior change (Prochaska et. al, 1994). Lastly, maintenance is the stage when the individual continues with a behavior change for over six months following the action stage (Prochaska et. al, 1994). The processes of change are made up of the activities that help the individual make it through the different stages of change (Prochaska & DiClemente, 1982). Decisional balance is a construct that weighs the pros and cons of making a behavior change by assessing potential gains or losses involved with the behavior change (Prochaska et. al, 1994). Self-efficacy is the confidence that an individual has to make the behavior change successfully (Bandura, 1977). Combination of all constructs of the TTM can

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provide a framework for observing a behavior change, applied to composting behavior among college students in dining halls on-campus.

Other theories that have been used include the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). The TRA looks at the behavioral intention of the individual to make a behavior change and the subjective norms that may influence the behavior (Taylor & Todd, 1997). Much of the time, individuals have a positive attitude toward environmental programs, but may not feel that same way about waste management initiatives (Taylor & Todd, 1997). Taylor and Todd (1997) found that the TRA does not fit well in the environmental context of changing behavior and more knowledge about composting could change behavior. However, perceived behavioral control was interrelated to behavioral intention applied to composting behavior (Taylor & Todd, 1997). Self-efficacy was also related to behavioral intention to start composting, once the proper resources and information were made available to individuals (Taylor & Todd, 1997). Boosting knowledge pertaining to composting among individuals showed the most impact on an individual's behavioral intention to compost.

The Theory of Planned Behavior (TPB) is also important for behavior change to occur among an individual (Huang, Gregoire, Tangney, & Stone, 2011). Sustainable practices among foodservice departments in the hospital setting showed that composting was one of the least used practices, while recycling was used most often (Huang et al., 2011). Directors of the hospital setting felt a huge responsibility to use certain sustainability practices and took into account the feelings of the patients when making environmental related decisions (Huang et al., 2011). The administration of the hospital took care of enforcing the appropriate measures necessary for patients to feel comfortable and ensure sustainability practices were implemented.

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The TTM's construct of the stages of change have often been used in studies looking at the initiation of exercise behavior (Kim, 2010). Self-efficacy is a very strong component to allow for a stage change over time (Kim, 2010). The presence of a fitness or sports skills class among study participants, looking into the exercise stages of change, showed a 72% increase from 20% in those individuals within the action stage (Kim, 2010). The presence of education was effective for exercise and may also be true for changing other behaviors, such as composting among undergraduate college students (Kim, 2010; Patel et al., 2013). Therefore, self-efficacy is important to consider when promoting behavior change among individuals.

Different Types of Composting

Composting can be done in many different settings, including the residential environment or the school environment of college campuses. The residential environment process of composting is also known as backyard composting, in which leftover food is collected in a contained area of the yard (Lleó et al., 2013). Vermicomposting can also be an option for home composting, which includes the presence of earthworms in the compost bin which consume the waste material and output nutrient-dense castings or vermicasts (Lleó et al., 2013). The variety of types of home composting allows for easy compliance and specifications to be chosen among homeowners.

At the university level, composting processes can be similar to the earlier mentioned home composting, but some features are different due to the size of the waste generated. The Penn State Erie, the Behrend College started the collection of compostable materials from an on-campus dining hall and mixed that organic waste with leaves and garden rubbish in a static windrow compost pile (MacCready, Elbert, Quinn, & Potter, 2013). The addition of wood chips occurred in that pile and materials were mixed together (MacCready et al., 2013). The simplicity

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of utilizing already generated student waste and landscaping waste from the college allowed for sustainability that would save the institution money.

Other larger institutions have adapted composting initiatives on their campuses as well. Ohio University obtained an in-vessel composting system, which is used to decompose all materials collected from any scraps of food preparation at on-campus dining halls (McClure, 2009). Those on-campus composting vessels produce fertilizer that can be used on campus or sold to surrounding communities (McClure, 2009). Therefore, the university benefited from processing their organic waste into a product that helped their community and their neighbors.

Rather than having a composting vessel on-campus, some universities and colleges work with outside companies that compost their organic waste materials commercially (McClure, 2009). For example, the University of Washington pays a commercial composter to compost their generated organic waste materials from their on-campus dining halls (McClure, 2009). James Madison University also sends its food waste to a third party company that uses the leftovers produced in the dining halls before and after food preparation to create compost material (Ogundipe, 2011). Composting at this level for schools still provides a buyer for their organic waste and promotes environmental sustainability among students.

Several college campuses have continued to develop composting practices to avoid landfill waste (Saer, Lansing, Davitt, & Graves, 2013). Therefore the research question to ask is: would educating and informing James Madison University students about composting and other waste processes change their attitudes toward making a behavior change through the reduction of waste generation at on-campus dining halls?

Chapter 3: Methodology

Design and Sampling

The study was conducted with the use of a questionnaire and a pre-post test with a control group quasi-experimental design. The questionnaire was conducted among undergraduate students at James Madison University. The pre-test questionnaire sample size consisted of a total of 140 undergraduate students (males=26.4%, females=73.6%). The experimental group included 60 undergraduate students and the control group included 80 undergraduate students. The majority of respondents were freshmen (77.9%), followed by sophomores (14.3%). The average age of respondents was 18.6 years old, with 55.7% of respondents being 18 years old. Only 5% of the respondents indicated that they live off-campus, while the remaining 95% all live in on-campus dormitories. For a full extent of descriptive data for the overall sample, refer to Table 1.

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

		(n)	Percentage (%)
Sex	Male	37	26.4%
	Female	103	73.6%
Academic Year	Freshman	109	77.9%
	Sophomore	20	14.3%
	Junior	11	7.9%
	Senior	0	0%
Age	18	78	55.7%
	19	44	31.4%
	20	13	9.3%
	21	3	2.1%
	22	1	0.7%
	24	1	0.7%
Grouping	Control	80	57.1%
	Experiment	60	42.9%

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Procedure

Questionnaires were distributed to students during one section of an introductory health sciences class and during hall meetings in McGraw-Long Hall, Shenandoah Hall, and Potomac Hall. Originally all on-campus residence halls were randomized and selected for the control and experimental groups, however scheduling conflicts and a lack of response from selected residence hall advisors led to a convenience or non-probability sample. A five to ten minute long PowerPoint presentation of information on composting, its importance and ways students could get involved in dining halls by composting was presented to the sample of students in the experimental group within the various residence halls during community floor meetings. Prior to the presentation, students were given a pre-test questionnaire. Following the presentation, students took the first post-test to assess any changes. The control group did not receive the presentation of information and only took the pre-test questionnaire. Two weeks after the presentation, students in both the experimental group and control group received an e-mail asking for their input to take an additional post-test questionnaire to account for any changes overtime.

Once the students completed their questionnaires, they submitted them into an envelope and their consent forms were also placed in a separate envelope to ensure confidentiality and anonymity. 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 two numbers of their birth month, the first two letters of their mother's maiden name, the first two letters of their hometown, and the last two numbers of their home zip code, to make up an eight-digit string of numbers and letters. Consent forms were separate from the questionnaires and the e-mail addresses provided on the consent form were generated into a list onto a Microsoft Excel

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Spreadsheet. The list of e-mail addresses obtained were used to send out a follow-up post-test questionnaire via Qualtrics, following the completion of the pre-test questionnaire and presentation.

Hypothesis

The more knowledge and awareness students gain about on-campus composting at dining halls, the more they will compost on campus and change their previous waste disposal habits.

Instruments and Scoring

I. Information and Awareness

Knowledge related to on-campus composting was measured using several questions to assess the retention of information presented in the presentation and test participants' previous knowledge on the subject. The questions were created specifically for this study to measure composting behaviors and knowledge.

Participants answered with the options "yes", "no", or "not sure." The answers were summed to produce an interval score. The more correctly answered questions, the more knowledge the participants have on composting information. The most accurate answer for each question follows:

-Is there on-campus composting at dining halls? Answer=Yes

-Is composting helpful to the soil? Answer=Yes

-Does composting provide waste reduction? Answer=Yes

-Can plastic bottles go into the compost bins? Answer=No

-Can dining hall napkins and containers go into the compost bin? Answer=Yes

-Can composting lower food costs? Answer=Yes

-Which dining halls have compost bins? Answer=Dukes, Festival, and Top Dog

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-Are there other waste alternatives to composting? Answer=Yes

-Do you personally benefit from composting on-campus? Answer=Yes

-Is composting the best option for waste management on-campus? Answer=No

II. Stages of Change

The stages of change were measured using the general health survey questions applied to composting (Nigg et al, 1999). This instrument was used to classify smoking behaviors and study participants' stages of change (Velicer, Prochaska, Fava, Laforge, & Rossi, 1999). Each response to the two selected questions from this instrument were categorized into the different stages of change based on the response options, A, B, C, D, and E (Nigg et al., 1999). Response A=the maintenance stage, response B=the action stage, response C=the preparation stage, response D=the contemplation stage, and E=the precontemplation stage (Nigg et al., 1999). Those choices (A-E) were scored and summed from each question which produced an interval score. The instrument has sufficient reliability and validity (Velicer et al., 1999).

III. Self-Efficacy

Self-efficacy was measured with statements used to describe consumer composting activity to evaluate their beliefs on the subject (Taylor & Todd, 1997). The instrument consists of two statements with responses that can fall within a 5-point Likert scale (Taylor & Todd, 1997). Responses were chosen to describe the participant's level of agreeability with each statement, ranging from 1=Strongly Disagree, 2=Disagree, 3=Neither Agree Nor Disagree, 4=Agree 5=Strongly Agree (Taylor & Todd, 1997). Responses scored were summed to produce an interval score.

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A lower score indicates a lower level of agreeability with the statements. The instrument was developed through analysis of methods used in previous research studies for reliability and validity for measuring this variable (Ajzen, 1991).

IV.

Attitude

Attitude was measured with the evaluation of two options within two statements. In the first statement, participants chose between “dislike” or “like”, when assessing their idea of composting (Taylor & Todd, 1997). In the second statement, participants chose between “bad” or “good”, when assessing their attitude toward composting (Taylor & Todd, 1997). Choosing the “like” option or “good” option indicated the participant would have a positive attitude toward composting (Taylor & Todd, 1997). The choices of “dislike” or “bad” indicated the participant would have a negative attitude toward composting (Taylor & Todd, 1997). Responses selected were scored and summed for each choice to produce an interval score. The instrument was developed through analysis of methods used in previous research studies for reliability and validity for measuring this variable (Ajzen, 1991).

Chapter 4: Results

For the experimental group, 98.3% (n=59) of students took the first post-test, while 43.3% (n=26) of students took the second post-test. The attrition rate for the experimental group first post-test was 1.7% and 56.7% for the second post-test. For the control group, 31.3% (n=25) of students took the post-test and the attrition rate was 68.7%.

Data were compiled into scale variables to measure changes from pre to post and second post tests. Only significant results are reported here.

Information and Awareness

The nine items on the questionnaire measuring participants' knowledge related to composting were scored using a scale variable. The items that comprised this scale variable were the following questions: is there on-campus composting at dining halls, is composting helpful to the soil, does composting provide waste reduction, can plastic bottles go into the compost bins, can dining hall napkins and containers go into the compost bin, can composting lower food costs, are there other waste alternatives to composting, do you personally benefit from composting on-campus, and is composting the best option for waste management on-campus. The possible range of summary scores for this variable was between 9.00 and 27.00, while each question had a range from 1.00 to 3.00 (1.00 is yes, 2.00 is no, and 3.00 is not sure).

The Stages of Change

Two questions were scored through the use of a scale variable to measure level of readiness to make a behavior change and compost. The stages of change include precontemplation, contemplation, preparation, action, and maintenance (Prochaska et. al, 1994). Precontemplation is when the participant is not considering composting within the next six months (Prochaska et. al, 1994). Contemplation is when the participant is seriously considering

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composting within the next six months (Prochaska et. al, 1994). A participant is in the preparation stage if they made a failed attempt at composting and continue to consider composting within the next month (Prochaska et. al, 1994). The action stage is when participants are composting (Prochaska et. al, 1994). Finally, maintenance is when the participant continues composting into the next six months (Prochaska et. al, 1994). Those items used to measure the participants' stage of change asked, do you consistently compost in dining halls on-campus and have you attempted to compost in dining halls on-campus. The possible responses ranged from 2.00 to 10.00, while each question had a range from 1.00 to 5.00 (1.00 is the maintenance stage, 2.00 is the action stage, 3.00 is the preparation stage, 4.00 is the contemplation stage, and 5.00 is the precontemplation stage). A chi-square test identifies a relationship between pre-test and post-test scores, $X^2(15, N=58) = 112.59, p < .01$. Test score differences were significant for pre-test to post-test because more participants reported being in maintenance and action stages of change following the educational presentation.

Self-efficacy

Two questions were scored through the use of a scale variable to measure self-efficacy. Those items asked participants to describe their level of desirability for the following statements: *"I do not know what should be composted"* and *"I cannot figure out how to compost effectively"*. Possible summary scores ranged from 2.00 to 10.00, while each statement had a range of 1.00 to 5.00 (1.00 is strongly disagree, 2.00 is disagree, 3.00 is neither agree nor disagree, 4.00 is agree, and 5.00 is strongly agree). A chi-square test identifies a relationship between pre-test and post-test scores, $X^2(48, N=58) = 78.48, p < .01$; with more participants reporting confidence in their ability to compost effectively and appropriately after the educational presentation.

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Attitude

Two questions were scored through the use of a scale variable created to measure participants' attitude toward composting. Participants were asked whether they dislike or like the idea of composting and if they have a bad or good attitude toward composting. Possible summery scores ranged from 2.00 to 4.00, while each word selection had a range of 1.00 to 2.00. A chi-square test was performed and a relationship between pre-test and post-test scores was found, $X^2(2, N=59) = 38.64, p < .01$. Differences between pre-test and post-test scores were significant because positive attitudes were reported among participants after the educational presentation.

Composting Behavior

Composting behavior was self-reported by asking participants how often they compost in dining halls per week. On average, the students within the control group reported composting 4.8 times per week on the pre-test questionnaire and reported 6.3 times per week on the post-test questionnaire. The students within the experimental group reported composting 5.7 times per week on the pre-test questionnaire and reported composting 8.6 times per week. Composting behavior increased by 1.5 times more per week for the control group and 2.2 times per week for the experimental group.

The data analysis of the study variables showed some significance overall. Although not much significance was found within groups and between test scores for groups, the collected data shows trends of composting behavior and attitudes among James Madison University undergraduate students. A detailed explanation of the results and any implications of the study and results will be discussed with a consideration for any observed changes.

Chapter 5: Discussion

It was hypothesized that with increased knowledge and providing more information about composting on-campus as an option for waste reduction, students would choose to compost more often and develop healthier waste disposal habits when eating at dining halls. Through data analysis little statistical significance was found, however comparison of scores between control and experimental groups showed some differences to support the hypothesis. The experimental group showed slightly lower pre-test scores, but improved by 20% on the second post-test questionnaire after the presentation. Providing information and handing out the questionnaires to students created awareness because it provided them with a framework necessary to be able to properly dispose of certain waste materials which has been outlined by previous research (Alshuwaikhat & Abubakar, 2008; Bartlett, 2011).

The Transtheoretical Model (TTM) of Behavior Change was utilized to observe any changes in the stages of change for composting behavior and participants' self-efficacy to compost. Pre-test questionnaires showed that 54% (n=76) of participants were in the maintenance stage, indicating that they have been composting for more than six months before participating in this study. By the second post-test, about 69% (n=18) of participants in the experimental group were classified as being in the maintenance stage. An individual can be in the action stage between zero and six months after the behavior change has occurred, while the stage of maintenance begins when the behavior change has occurred for at least six months and continues until termination of the behavior that was changed (Prochaska et al., 1994). The stage of maintenance within behavior change theory is recognized as a lasting and continuous change (Prochaska et al., 1994). This stage requires that the individual successfully complete the behavior change as time passes, which was observed in this study.

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The significance found for pre-test and post-test score differences for the stages of change means participants within the experimental group made a stage change to healthier behavior. By the second post-test, no individuals were in the precontemplation stage, also the first stage of behavior change in which no serious consideration for behavior change is apparent to the individual (Prochaska et al., 1994). Interventions are more efficacious when tailored to the relative stage of participants (Nigg et al., 1999, Patel et al., 2013).

Another construct of the TTM, participants' self-efficacy to compost, was observed before and following an educational presentation of information on composting. Previous researchers have found self-efficacy is a driving force in behavior change overtime and building up students' self-confidence allows them to choose the most suitable waste disposal method with lasting benefits to the environment (Kim, 2010; Patel et al., 2013). The significance found between pre-test and post-test scores in the experimental group shows individuals appear to have gained a better understanding about their ability to compost. Participants as a whole also reported high levels of self-confidence in themselves to compost. High self-efficacy has had a positive effect on how an individual chooses to behave (Taylor & Todd, 1997).

Overall both groups of participants liked the idea of composting and had a good attitude towards composting. With a positive attitude much of the time, behavior change can be embraced by the individual (Taylor & Todd, 1997). By also looking at how often each group composted each week, behavior change could be observed and rates of composting increased over time. Although both groups made improvements in composting, the experimental group showed greater improvements in behavior.

Researchers have indicated the responsibility university settings have in leading sustainability and environmental health promotion programs is essential for environmental

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change (Alshuwaikhat & Abubakar, 2008; Bartlett, 2011; Emanuel & Adams, 2011). Freshmen living on-campus were targeted for this study because of the future potential they have to compost more and promote that behavior within the community. Those freshmen who actively play a role in the improvement of the university environment can act as models for their peers in changing norms to have composting widely accepted on-campus as suggested by Baldwin and Dripps (2012).

Limitations

Some limitations may have affected the research study's results. The large number of freshmen students represented in the data only represents a small portion of undergraduate college students at JMU. The high attrition from pre-test response to post-test questionnaire responses limited the sample size. Sample size was also low due to limited access to students living on-campus. The PowerPoint educational presentation on composting was considerably short due to time constraints and student scheduling conflicts. Students self-reported how often they composted during a week at the dining halls which may not have been an accurate count for this variable. Not all students included in this study live on campus; therefore they may not eat at dining halls. While taking the online post-test questionnaire via Qualtrics, respondents could have looked up answers to the questions to score more accurately on it. Many survey questions were developed and amended specifically for this study on composting.

Conclusions

After thorough discussion of the research variables, some conclusions can be made. James Madison University, as a large community of individuals, would benefit from offering more educational presentations or social marketing campaigns dedicated to environmental health issues. By promoting students and faculty to learn more about composting and allowing the administration to organize environmental health programs on campus, the university can use

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their impact as a model for the surrounding community and society as a whole. JMU undergraduate students are composting and have positive feelings and attitudes toward this environmental sustainability technique. The positivity that students project around one another can be used for the continuity of change within the university community. More composting done within university dining halls is a collective effort that will involve all individuals on campus.

Suggestions for Future Research

Further research is needed on the short-term and long-term effects of a university-wide campaign to reduce unnecessary waste production. Additionally, behavioral intention and subjective norms, as constructs within the theory of reasoned action, should be explored among university students and faculty pertaining to composting behavior. Also many research articles mention the importance of educating students to see change occur, but none have extensively developed a generalized comprehensive action plan and make programs promoting composting successful. Future researchers should create a longer time frame to measure behavior change, such as six months to a year while also accounting for any confounding factors that may affect an individual's reason to compost. Decisional balance within the TTM can be an important construct for seeing a behavior change occur and should be considered in the future.

In conclusion, environmental health issues are important to keeping our planet healthy and ensuring that individuals have a safe ecosystem to live in. Through the reduction of waste, recycling, and reusing materials, natural resources are conserved. Individuals can become a part of the process and promote environmentally healthy choices in their communities.

Appendix A

Consent to Participate in Research

Identification of Investigators & Purpose of Study

You are being asked to participate in a research study conducted by Ashleigh Beben and Dr. Georgia Polacek from James Madison University. The purpose of this study is to examine knowledge, attitudes and behaviors of composting. This study will contribute to the researcher's completion of her senior thesis.

Research Procedures

Should you decide to participate in this research study, you will be asked to sign this consent form once all your questions have been answered to your satisfaction. This study consists of a survey and/or presentation that will be administered to individual participants in Rockingham, Eagle, Shenandoah, Huffman, Potomac, White, Chapplelear, Chesapeake, Oak, and McGraw-Long Hall. You will be asked to provide answers to a series of questions related to composting knowledge and behaviors on-campus.

Time Required

Participation in this study will require up to 1 hour of your time.

Risks

The investigator does not perceive more than minimal risks from your involvement in this study (that is, no risks beyond the risks associated with everyday life).

Benefits

Potential benefits from participation in this study include gaining knowledge about on-campus composting and ways to make environmentally healthy decisions related to waste processes. Overall, making the sample of students aware of composting options is important and causing more students to decide to compost in dining halls on-campus. This research will also help researchers and practitioners identify the impacts of composting at JMU.

Confidentiality

The results of this research will be presented at classroom, conference, etc. The results of this project will be coded in such a way that the respondent's identity will not be attached to the final form of this study. The researcher retains the right to use and publish non-identifiable data. While individual responses are confidential, aggregate data will be presented representing averages or generalizations about the responses as a whole. All data will be stored in a locked filing cabinet accessible only to the researcher and advisor. Upon completion of the study, all information that matches up individual respondents with their answers will be destroyed.

Participation & Withdrawal

Your participation is entirely voluntary. You are free to choose not to participate. Should you choose to participate, you can withdraw at any time without consequences of any kind.

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Questions about the Study

If you have questions or concerns during the time of your participation in this study, or after its completion or you would like to receive a copy of the final aggregate results of this study, please contact:

Ashleigh Beben
Department of Health Sciences
James Madison University
bebenax@dukes.jmu.edu
polacegn@jmu.edu

Dr. Georgia Polacek
Department of Health Sciences
James Madison University
Telephone: (540) 568-3642

Questions about Your Rights as a Research Subject

Dr. David Cockley
Chair, Institutional Review Board
James Madison University
(540) 568-2834
cocklede@jmu.edu

Giving of Consent

I have read this consent form and I understand what is being requested of me as a participant in this study. I freely consent to participate. I have been given satisfactory answers to my questions. The investigator provided me with a copy of this form. I certify that I am at least 18 years of age.

Name of Participant (Printed)

E-mail Address of Participant (Printed)

Unique Identifier (8-digits)

Name of Participant (Signed)

Date

Name of Researcher (Signed)

Date

Approved by the IRB with the following Protocol number: 15-0283

Appendix B

Pre-test Questionnaire

HON 499: Senior Honors Thesis

Instructions: Please check the box for the answer that best describes you and fill in the blank with the appropriate answer.

Sex: Male Female Other

Academic Year: Freshman Sophomore Junior Senior

Age: _____

Unique identifier:

2 numbers of your birth month

(I.e. September=09): _____

First 2 letters of your mother's maiden name

(I.e. Jastremski=JA): _____

First 2 letters of your hometown

(I.e. Springfield=SP): _____

Last 2 numbers of your home zip code

(I.e. 22153=53): _____

8-digit identifier

(I.e 09JASP53): _____

What residence hall do you reside in? _____

Instructions: Please read the following questions and all the possible answers carefully. Choose the best response for each question and tick the appropriate box.

Where do you normally eat on-campus? (Check all that apply.)

E-Hall D-Hall Festival Top Dog Dukes Market One Mrs. Greens

Instructions: For the following questions, select the best answer with a check in one box.

Is there on-campus composting at dining halls? Yes No Not Sure

I dislike OR like the idea of composting.

I have a bad OR good attitude toward composting.

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Is composting helpful to the soil? Yes No Not Sure

Does composting provide waste reduction? Yes No Not Sure

Can plastic bottles go into the compost bin? Yes No Not Sure

Can dining hall napkins and containers go into the compost bin? Yes No Not Sure

Can composting lower food costs? Yes No Not Sure

Are there other waste alternatives to composting? Yes No Not Sure

Do you personally benefit from composting on-campus? Yes No Not Sure

Is composting the best option for waste management on-campus? Yes No Not Sure

How often do you compost in dining halls per week?
(only ONE number value, I.e. one) _____

Which dining halls have compost bins? (Check all that apply.)

Dukes Festival Top Dog None

Do you consistently compost in dining halls on-campus? (Check ONLY one that applies.)

a. YES, I have been for more than 6 months.

b. YES, I have been, but for LESS than 6 months.

c. NO, but I intend to in the next 30 days.

d. NO, but I intend to in the next 6 months.

e. NO, and I do NOT intend to in the next 6 months.

Have you attempted to compost in dining halls on-campus?
(Check ONLY one that applies.)

a. YES, I have been for more than 6 months.

b. YES, I have been, but for LESS than 6 months.

c. NO, but I intend to in the next 30 days.

d. NO, but I intend to in the next 6 months.

e. NO, and I do NOT intend to in the next 6 months.

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Instructions: On a scale from 1 (strongly disagree) to 5 (strongly agree), please circle the number that best describes your level of agreeability for each statement.

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
I do not know what should be composted.	1	2	3	4	5
I cannot figure out how to compost effectively.	1	2	3	4	5

Appendix C

**Post-test Questionnaire
HON 499: Senior Honors Thesis**

Instructions: Fill in the blank with the most appropriate answer.

**Unique identifier:
2 numbers of your birth month
(I.e. September=09):**_____

**First 2 letters of your mother's maiden name
(I.e. Jastremski=JA):**_____

**First 2 letters of your hometown
(I.e. Springfield=SP):**_____

**Last 2 numbers of your home zip code
(I.e. 22153=53):**_____

**8-digit identifier
(I.e 09JASP53):**_____

Instructions: Please read the following questions and all the possible answers carefully. Choose the best response for each question and tick the appropriate box.

Where do you normally eat on-campus? (Check all that apply.)

E-Hall D-Hall Festival Top Dog Dukes Market One Mrs. Greens

Instructions: For the following questions, select the best answer with a check in one box.

Is there on-campus composting at dining halls? Yes No Not Sure

I dislike OR like the idea of composting.

I have a bad OR good attitude toward composting.

Is composting helpful to the soil? Yes No Not Sure

Does composting provide waste reduction? Yes No Not Sure

Can plastic bottles go into the compost bin? Yes No Not Sure

Can dining hall napkins and containers go into the compost bin? Yes No Not Sure

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Can composting lower food costs? Yes No Not Sure

Are there other waste alternatives to composting? Yes No Not Sure

Do you personally benefit from composting on-campus? Yes No Not Sure

Is composting the best option for waste management on-campus? Yes No Not Sure

How often do you compost in dining halls per week?
(only ONE number value, I.e. one) _____

Which dining halls have compost bins? (Check all that apply.)

Dukes Festival Top Dog None

Do you consistently compost in dining halls on-campus? (Check ONLY one that applies.)

- a. YES, I have been for more than 6 months.
- b. YES, I have been, but for LESS than 6 months.
- c. NO, but I intend to in the next 30 days.
- d. NO, but I intend to in the next 6 months.
- e. NO, and I do NOT intend to in the next 6 months.

Have you attempted to compost in dining halls on-campus? (Check ONLY one that applies.)

- a. YES, I have been for more than 6 months.
- b. YES, I have been, but for LESS than 6 months.
- c. NO, but I intend to in the next 30 days.
- d. NO, but I intend to in the next 6 months.
- e. NO, and I do NOT intend to in the next 6 months.

Instructions: On a scale from 1 (strongly disagree) to 5 (strongly agree), please circle the number that best describes your level of agreeability for each statement.

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
I do not know what should be composted.	1	2	3	4	5
I cannot figure out how to compost effectively.	1	2	3	4	5

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If you are not composting consistently, please explain why? (Check all that apply.)

I forget to compost.

It doesn't matter to me.

Composting provide me no benefits.

Qualtrics post-test survey link: http://jmu.co1.qualtrics.com/SE/?SID=SV_3BKpdkSRIf0kPb

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