Factors Influencing Post-consumer Recycling Behaviors of the Bemidji State University Population.

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April 2011

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Abstract

The purpose of my research is to better understand what dictates an individual's decision to recycle a portion of their post-consumer waste or not. I chose to focus on consumer recycling because it has always sparked my interest. Recycling is an everyday occurrence and a simple way to help limit and minimize waste, and is important for those very same reasons. Recycling is a personal decision one can make regarding the reuse of our natural resources. Research was done on similar studies concerning recycling behavior. A survey was created and given to members of the Bemidji State University (BSU) population, including students, faculty and staff. Data was compiled and tested using Statistical Package for the Social Sciences (SPSS) and compared with results of previous studies to evaluate any similarities or differences. Findings included overall positive attitudes toward recycling, with convenience and understanding of recycling benefits being the biggest influencing factors of recycling behavior.

Acknowledgements

I would like to thank the following persons and organizations for their wisdom and support,

Dr. Fu-Hsian Chang - Thesis Advisor
Dr. Pat Welle - Statistics Advisor
Dr. Tim Kroeger and The Minnesota Space Grant Consortium
Dr. Lisa Erwin – V.P. of Student Development and Enrollment
The Recycling Association of Minnesota
The BSUFA
Erika Bailey-Johnson
All survey participants

My research would not have been possible without all of you.

Sincerely,

Kaitlin Boutelle

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Introduction

Recycling is the reclamation or reuse of waste materials (Tompeck, 2006). Some of the most commonly recycled materials today are paper, glass, aluminum, and some plastics (Ashworth, 2001). One of the problems with recycling is the lack of economic market for recycled goods, because virgin materials are sometimes cheaper than the recycled material (Tompeck, 2006). This factor is often used when arguing against recycling in claiming that recycling is not cost effective. It is true that the benefits of recycling are not always economically obvious or immediate; however it is widely known that the current rate of consumption and waste production cannot continue to be environmentally supported (Tompeck, 2006).

Over the last several decades public awareness and concern about environmental pollution, along with increasingly less space to "dump" municipal solid wastes helped promote recycling practices. Material and labor shortages during World War II brought the importance of recycling to the public's attention (McGinnis, 1995), but the dawn of the 1970s spurred the current recycling era. The energy crisis caused alarm and created an understanding of the importance in society as a whole participating in conservation. This was supposedly less in response to economic factors and more for the protection of the environment and conservation of raw materials (McGinnis, 1995).

This consumer-driven recycling incorporates post-consumer waste which is waste simply discarded after use, not waste created in the production of a product (McGinnis, 1995). In Canada, the first test of the "blue-box recycling system" was tried in 1977. Households participate in this system by collecting recyclables in a blue box. The box is placed on the curb weekly or bi-weekly to be picked up by the recycling service. The "blue-box recycling system" is the form of residential recycling in the United States most commonly seen today (McGinnis, 1995).

While it is true that recycling items such as plastic can be more expensive than using virgin material, there is an increasing market for recycled goods such as aluminum and paper (Ashworth, 2001). Aluminum and paper actually create revenue for municipal waste programs. Recycled aluminum uses less than 10 percent of the energy that would be required to process the same amount from ore (Ashworth, 2001).

Along with increased support for post-consumer product recycling, another hope is to get manufacturers to take more responsibility for the recycling and reuse of their products, especially problematic ones such as batteries and, more recently, electronics (Ashworth, 2001). It is anticipated that increased social awareness of the importance of recycling will continue to grow and cause legislation to be passed to promote recycling efforts (Tompeck, 2006).

This research is intended to determine what social or motivating factors influence a person's decision to recycle post-consumer waste products or not. A short survey was used to collect data on members of the BSU population. This research is important because consumer recycling can help minimize waste and require less manufacturing of virgin materials. As a

consumer in today's society, choosing to recycle is an everyday decision one can make regarding the conservation of natural resources.

Currently recycling is a personal choice and is voluntary like many other decisions regarding the environment. The importance of recycling is gaining recognition, and this research is intended to help understand the opinions of consumers.

The following sections will demonstrate a review of related studies and literature, the methods used for data collection, and the results of the survey, along with discussion and conclusions based on those results.

Literature Review

Recycling Behavior: A Multidimensional Approach was a study completed in 2005. It aimed to understand recycling roles within the household. Glass recycling was chosen to be the focus. Researchers randomly distributed 358 surveys in a metropolitan area. The surveys measured aspects such as motivation to recycle, the actual action of recycling, and several statements in which the respondents would indicate the degree to which they related with a certain statement. Likert-type scales were used throughout the survey questions in order to capture responses uniformly (Meneses, 2005).

It was found that women felt they bore more burdens for recycling in the household than men. Also, members of the household between the ages of 31 and 45, average working age, were most likely to initiate the act of recycling. Household members 23 and younger were least likely to have any impact on household recycling, positive or negative. (Meneses, 2005). This study was important when comparing my results with past collected data. Questions from the survey and variables used in this study were helpful when developing the survey for my research. A similar Likert-type scale was used in a few of my survey questions. Different age groups' likelihood of recycling was also compared between this study and my own data.

I'm Not in the Habit of Recycling, was a study done in Scotland, United Kingdom beginning in 2000. Its intent was to measure the role that habit played with regard to recycling behavior. Participants included 252 people from the Glasgow area. Participants were approached in public areas such as shopping malls, coffee shops, and train stations. Participants were asked to indicate their responses to a series of statements based on seven-point scales, for example one ranging from strongly agree to strongly disagree. The statements were sections relating to categories such as attitude, intent to recycle, and past recycling behavior among others (Knussen, 2008).

It was found that the most highly reported reason for not recycling was because recycling facilities were not convenient enough. The next two most reported reasons for not recycling were the lack of curbside services and simply not being in the habit of recycling. It was concluded that lack of habit did have a significant influence on intention to recycle, but this did not mean that those with a lack of habit had a less favorable attitude toward recycling (Knussen, 2008). This study was most similar to what I wished to carry out in my recycling

study. It was a key model in methodology and survey formulation, and was also very relevant to discussion of results.

A book called *Recycling in America* contains factual information regarding recycling history, recycling program explanation, product facts, and state and federal regulations of the U.S. The book's information is organized by state. This book was particularly useful for recycling data on Minnesota. This book's data and facts were used to clarify and reference specific factual points. Statistics from this book were also used for comparison when reporting the findings of my study. It was useful for comparing findings at BSU with the recycling behavior of Minnesota overall (Strong, 1997).

In 2006, the senate ordered the U.S. Government Accountability Office (GAO) to perform a study meant to determine how municipal recycling could be increased. The GAO interviewed recycling coordinators in eleven of the largest cities across the US which had curbside recycling programs. Laws and regulations were reviewed along with EPA programs, and other studies from government, academia, and non-profit organizations. It was found that the interviewed city officials were doing three main things to increase recycling: making recycling easy and convenient, offering financial incentives, and creating public education and outreach programs (U.S. GAO, 2006).

This study was helpful because of the information it contains on how cities across the United States are attempting to combat negative influencers of recycling. It was used to understand more of what the federal government is doing to promote recycling and what could work to increase recycling in other areas.

Recycling and the Politics of Urban Waste is a book containing factual information about recycling and waste management, explanatory opinions, and reports from studies done in several large cities such as New York City and London. The reports were done by combining existing facts and information regarding the waste history of each city. It was concluded that recycling would be an important piece of each city's ongoing waste management plans.

Included in the book is a section called *Recycling in Perspective* containing opinions and common explanations for recycling which was used in comparison with my survey results (Gandy, 1994). This book was also helpful in identifying reasons to support recycling practices.

Determinants of Recycling Behavior: A Synthesis of Research Results was a research study done using meta-analysis to analyze a compilation of recycling behavior data from 1968 to 1995. It was done by combining the empirical data from 67 separate studies and analyzing the compiled data. Each individual study was coded by a small team of researchers in order to unify the data. Five independent variables were identified including intrinsic incentives, extrinsic incentives, internal facilitators, external facilitators, and demographic variables. Three dependent variables were identified based on widely used recycling literature. These included consumers' attitudes toward recycling, behavioral intentions, and actual recycling behavior (Hornik, 1995). Because not one of these dependent variables had a significant difference in

correlation, the researchers combined the three and called it, "propensity to recycle," (Hornik, 1995).

The researchers concluded that internal facilitators such as knowledge, awareness, and commitment were the strongest predictors of recycling behavior. It was also concluded that demographic variables such as gender and education level were weakly influential despite reports from other scholarly articles (Hornik, 1995). This study proved to be an important example in analyzing and organizing the data collected in my study. It was also useful when comparing results of previous studies to the results of this survey.

Problem Statement and Hypothesis

Recycling is a voluntary behavior and is not always recognized for its importance in minimizing waste. It was hypothesized that consumers are optimistic toward the idea of recycling, but convenience factors and long-time habits may hinder the actual behavior of recycling.

Project Goals and Objectives

The goals of this study were to get a better understanding of how Bemidji State University consumers think and behave when it comes to recycling, while also bringing awareness to the benefits and importance of recycling.

Methods and Data Collection

Using input from Dr. Fu-Hsian Chang, Erika Bailey-Johnson, and several of the studies researched, a survey was created concerning behavior and attitude toward recycling. Survey participants included students, faculty, and staff from Bemidji State University (BSU). Participants were required to be at least 18 years of age. The survey measured variables such as age, gender, BSU affiliation, frequency of recycling, location of recycling, and more (see Appendix A for a sample of the survey).

Surveys were distributed by email to a random selection of BSU students, faculty, and staff in the 2010 spring semester (see Appendix B for the survey instructions, informed consent form, and debriefing). Responses were then collected via email using the online survey generator *Survey Monkey*. Data was compiled using Microsoft Excel, then manipulated, re-coded, and statistically tested using Statistical Package for the Social Sciences (SPSS). Dr. Pat Welle advised on applicable techniques of statistical analysis. Alpha levels of 0.01, 0.05. 0.10 were deemed as appropriate levels of significance for this study. The level of 0.10 was chosen to ensure some statistical findings would be discovered to present to the reader.

Several of the survey questions were re-coded in order to simplify and create ease in statistical interpretation. Questions including the answer scale from *always* to *never* were re-coded as numerical values from four through zero, respectively. Questions using the Likert-type scale from 1 through 7 were re-coded into a scale from -3 to +3, respectively. This way,

reported attitudes toward recycling were more easily interpreted as being positive or negative. See Appendix A for more detailed information on how each response value was re-coded.

Statistical testing included descriptive statistics such as frequency and means of responses, as well as independent sample t-tests and one-way analysis of variance (ANOVA). Descriptive testing was done for each survey question to determine the number and percent of respondents that chose a particular answer. Means were calculated to determine the average age, gender, affiliation, attitude, and behaviors of the survey respondents. Because the gender variable contained only two different groups, male or female, an independent sample t-test was used when comparing gender with other variables concerning recycling attitude and behavior. Independent sample t-tests were also used for the affiliation variable, as it contained the two groups, students or faculty/staff. Because the age variable contained four different groups, ANOVA was used to determine any significance between age groups when comparing age to other variables. A correlation coefficient test was done between the variables of importance and impact to determine if there was a significant relationship between those variables.

The data results of this survey and results from past recycling studies were combined to determine what factors are most likely to influence society's recycling behavior. Results from past studies were also used to compare BSU's recycling behavior and attitude with other locations.

Results

A total of 270 respondents participated in the survey. Of those, slightly more respondents were female than male, slightly more were BSU faculty or staff than students, and the average respondent was middle-aged. See Appendix A for specific percentages of responses to each survey question.

Respondents' Recycling Behaviors

When asked how frequently they recycled, on average respondents reported recycling *occasionally* to *whenever possible* (M=2.86). Respondents reported *rarely* to *occasionally* recycling at home growing up (M=1.73). In order to check consistency with reporting frequency of recycling, respondents were asked how often they recycle now. Respondents again reported recycling *occasionally* to *whenever possible* (M=2.86). When asked how often they planned to recycle in the future, respondents on average answered *whenever possible* (M=3.03).

The following table lists the products that respondents reported recycling. Products are listed in descending order from most commonly recycled to least commonly recycled.

Table 1

Products Recycled as indicated by Respondents

Products Recycled	% of respondents
Paper	91.5
Aluminum	89.3
Glass	81.5
Electronics	45.6
Batteries	38.5
Other Products	29.6
None	2.6

Over 80 percent of all respondents reported recycling paper, aluminum, and glass products. Only 2.6 percent of respondents reported recycling no products.

Because respondents were able to indicate several different responses for this question, a subsequent variable was created which represented the total number of products the respondent indicated for that answer. For example, a respondent who indicated recycling *paper*, *aluminum*, and *batteries*, was given a value of "3" in the new variable *product total*. A respondent indicating that no products were recycled was given a value of "0." The maximum value a respondent might receive in the *product total* variable was "6." The use of the *product total* variable will be discussed later in this section.

The following table lists locations where respondents reported active recycling. Locations are listed in descending order from most common location of recycling to least common location of recycling.

Table 2

Locations of Active Recycling as Indicated by Respondents

Locations of Recycling	% of respondents
Home	85.6
Work	74.8
Other public areas	60.0
School	45.9
None	1.9

The most commonly reported location of recycling was home at 85.6 percent. Over half of the respondents reported recycling at other locations as well. Only 1.9 percent of respondents reported recycling at no location.

Similar to the procedure used for creating the *product total* variable, the total number of locations of active recycling indicated by respondents was considered, and a subsequent variable was created called *location total*. Respondents received a value from "0" to "4" for the *Location total* variable, depending on the number of locations of active recycling they indicated, "4" meaning all locations were indicated and "0" meaning no location was indicated. Results and use of the *location total* variable will be discussed later in this section

The following table lists places respondents have learned about recycling. The places are listed in descending order from most commonly to least commonly reported.

Table 3

Locations where Respondents Learned about Recycling

Places where Recycling was Learned	% of Respondents
Home	64.8
School	58.5
Work	58.5
Friends or peers	49.6
Other	33.3
None	1.5

Home was the most common place respondents learned about recycling at 64.8 percent. School and work were both second most common at 58.5 percent. About half of respondents reported learning from friends or peers. Only 1.5 percent of respondents reported not learning about recycling.

Again similar to the *product total* and *location total* variables, a subsequent variable called *learned total* was created after considering the total number of places each respondent indicated where recycling was learned. Respondents received a value from "5" to "0" for the *learned total* variable, depending on the number of places they indicated learning about recycling, "5" meaning all places were indicated, and "0" meaning no place was indicated. Use of the *learned total* variable will be discussed later in this section.

Respondents were asked to indicate factors that might increase or decrease their likelihood to recycle. Factors increasing likelihood to recycle are listed in descending order in the table below.

Table 4

Factors Increasing Respondents' Likelihood to Recycle

Factors Increasing Recycling Likelihood	% of Respondents
Convenient recycling receptacles	90.7
Belief that recycling has benefits	78.9
Presence of a local recycling program	75.6
Clear labeling of receptacles	65.2
Personal interest in recycling	60.4
Knowledge about recycling	47.0
If family, roommates, or peers practice recycling	29.6

At least 75 percent or more of respondents reported that convenient receptacles, belief that recycling has benefits, and the presence of a local recycling program would increase their likelihood of recycling. About 60 to 65 percent of respondents also reported that clear labeling of receptacles and personal interest in recycling were also important in determining their recycling likelihood. Only 29.6 percent of respondents reported influence from their family, roommates', or peer's recycling behavior.

The next table shows factors that respondents reported would decrease their likelihood of recycling. These factors are listed in descending order from most likely to least likely to decrease recycling behavior.

Table 5

Factors Decreasing Respondents' Likelihood to Recycle

Factors Decreasing Recycling Likelihood	% of Respondents
Inconvenient recycling receptacles	72.6
Absence of local recycling program	68.5
Unclear labeling of receptacles	40.4
Belief that recycling has little or no benefits	18.9
If family, roommates, or peers don't practice recycling	14.8
No personal interest in recycling	10.7
No knowledge about recycling	8.5

Inconvenient receptacles and the absence of a local recycling program were the most commonly reported factors that would decrease respondents' likelihood to recycle.

Independent sample t-testing was done to determine any significant difference between gender and the variables frequency of recycling, total number of products recycled, total number of active recycling locations, and total number of places where recycling was learned.

The following table shows the mean responses between males and females for each of the four variables. Any significance found by each t-test is also noted in the table.

Table 6

Mean Responses of Male and Female Respondents on Frequency of Recycling, Total Products Recycled, Total Locations of Recycling, and Total Locations where Recycling was Learned

	Frequency	Product Total	Location Total	Learned Total
Male	2.82	3.77	2.62	2.72
Female	2.90	3.73	2.69	2.59

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

Results of the t-testing showed no significant difference between male and female respondents and frequency of recycling, the total number of products recycled, the total number of active recycling locations, or the total number of places where learning about recycling occurred.

Independent sample t-testing was also done to determine any significant difference between BSU affiliation and the variables of frequency of recycling, total number of products recycled, total number of active recycling locations, and total number of places where recycling was learned. The following table shows the mean responses between students and faculty/staff for each of the four variables. Any significance found by each t-test is also noted in the table.

Table 7

Mean Responses of Student and Faculty/Staff Respondents on Frequency of Recycling, Total Products Recycled, Total Locations of Recycling, and Total Locations where Recycling was Learned

	Frequency	Product Total	Location Total	Learned Total
Students	2.58***	3.31***	2.62	2.57
Faculty/Staff	3.07***	4.07***	2.69	2.70

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

Results of the t-testing showed that the faculty/staff reported frequency of recycling was significantly higher than what students reported. Also, faculty/staff reported a significantly higher number of total products recycled than students. No significant difference was found

between students and faculty/staff in total number of active recycling locations or total number of places where recycling was learned.

One-way ANOVA was used to determine any significant difference between age groups and seven variables including: frequency of recycling, total products recycled, total number of active recycling locations, total number of places recycling was learned, recycling frequency growing up, current recycling frequency, and recycling frequency in the future.

The following tables represent ANOVA results between age groups and reported frequency of recycling. The first table shows the mean reported recycling frequency of each age group and the second table shows any significance between the age groups.

Table 8

Mean Recycling Frequency Reported by each Age Group

	Recycling Frequency
18-25	2.61
26-39	2.70
40-59	3.06
60+	3.32

Significance in Recycling Frequency between Age Groups

	18-25	26-39	40-59
26-39			
40-59	***	***	
60+	***	***	

*significance at α=0.10

**significance at α=0.05

***significance at α=0.01

Results of the F-test on ANOVA showed significance between age groups at the 0.01 level. More specifically, respondents aged 40-59 reported significantly higher recycling frequency than ages 18-25 and ages 26-39. Ages 60+ also reported a significantly higher recycling frequency than ages 18-25 and 26-39. The level of significance is reported on the second table.

Results from the one-way ANOVA between age groups and the total number of products recycled are represented in the following tables. The first table shows the mean number of products recycled by each age group. The second table shows any significant differences between the age groups.

Table 9

Mean Number of Products Recycled by each Age Group

	Product Total
18-25	3.23
26-39	3.53
40-59	4.17
60+	4.32

Significance in Total Products Recycled between Age Groups

	18-25	26-39	40-59
26-39			
40-59	***	***	
60+	***	**	

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

The ANOVA F-test results showed significance between age groups at the 0.01 level. Respondents aged 40-59 recycled significantly more products than respondents aged 18-25 and 26-39. Similarly, respondents aged 60+ recycled significantly more products than ages 18-25 and 26-39. The significance levels are reported in the second table.

The following tables represent ANOVA results between age groups and total number of active recycling locations. The first table demonstrates the average number of recycling locations reported by each age group. The second table demonstrates any significant differences between age groups.

Table 10

Mean Number of Locations of Recycling Reported by each Age Group

	Location Total
18-25	2.69
26-39	2.48
40-59	2.72
60+	2.74

Significance in Total Active Recycling Locations between Age Groups

	18-25	26-39	40-59
26-39			
40-59			
60+			

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

Based on the F-test on ANOVA results, no significant difference was found between age groups and the total number of locations where respondents actively recycle.

ANOVA results between age groups and total places where respondents learned about recycling are represented in the following tables. The first table demonstrates the average number of learning places reported by each age group. The second table demonstrates any significant differences between age groups.

Table 11

Mean Reported Locations where Recycling was Learned by each Age Group

	Learned Total
18-25	2.61
26-39	2.57
40-59	2.72
60+	2.63

Significance in Total Places of Learning about Recycling between Age Groups

	18-25	26-39	40-59
26-39			
40-59			
60+			

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

The F-test on ANOVA results showed no significant difference between age groups and the total number of places where recycling was learned.

The next two tables represent ANOVA results between age and frequency of recycling growing up. The first table demonstrates each age group's average recycling frequency at home growing up. The second table demonstrates any significance between age groups.

Table 12

Mean Recycling Frequency Growing Up Reported by each Age Group

	Recycle Growing Up
18-25	2.35
26-39	2.57
40-59	2.72
60+	2.63

Significance in Recycling Behaviors Growing up between Age Groups

	18-25	26-39	40-59
26-39			
40-59	***	***	
60+	***	**	

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

Results of the F-test on ANOVA showed significance between age groups at the 0.01 level. Respondents aged 40-59 reported recycling significantly more at home growing up than respondents aged 18-25 and 26-39. Respondents aged 60+ also reported significantly higher recycling frequency at home growing up than ages 18-25 and 26-39. The levels of significance can be found in the second table.

The following tables represent ANOVA results between age groups and respondents' current recycling frequency. The first table shows the average recycling frequency reported by each age group. The second table shows any significance between age groups.

Table 13

Mean Current Recycling Frequency Reported by each Age Group

	Recycle Now
18-25	2.65
26-39	2.68
40-59	3.05
60+	3.32

Significance in Current Recycling Behaviors between Age Groups

	18-25	26-39	40-59
26-39			
40-59	***	***	
60+	***	***	

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

The F-test on ANOVA results showed significance between age groups at the 0.01 level. Respondents ages 40-59 reported significantly higher present recycling frequency than respondents ages 18-25 and 26-39. Respondents ages 60+ also reported significantly higher recycling frequency than respondents ages 18-25 and 26-39. The levels of significance can be found in the table.

ANOVA results between age and future recycling frequency can be found in the following two tables. The first table shows the average frequency of future recycling for each age group. The second table shows any significance between the age groups.

Table 14

Mean Future Recycling Frequency Reported by each Age Group

	Recycle Future
18-25	2.88
26-39	2.95
40-59	3.14
60+	3.37

Significance in future recycling behaviors between age groups

	18-25	26-39	40-59
26-39			
40-59	***	*	
60+	***	**	

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

The F-test on ANOVA showed significance between age groups at the 0.01 level. It was found that respondents aged 40-59 reported significantly higher future recycling frequency than respondents aged 18-25 and 26-39. Respondents 60+ also reported significantly higher future recycling frequency than respondents ages 18-25 and 26-39. The level of significance of these findings can be found in the second table.

Respondents' Attitudes Toward Recycling

When asked to rate the importance of recycling to them personally, respondents on average reported recycling to have at least some importance (M=1.87). When rating the impact recycling has on the environment, respondents on average reported a positive impact (M=2.12).

An independent sample t-test was done to determine whether or not gender affected a respondent's rating of recycling importance. A separate t-test was done to determine if gender affected the respondent's rating of recycling impact on the environment. The following table shows the mean ratings of recycling importance and impact between males and females.

Table 15

Mean Rating of Recycling Importance and Impact between Males and Females

	Importance	Impact
Male	1.62***	1.80***
Female	2.07***	2.37***

*significance at α=0.10

**significance at α=0.05

***significance at α=0.01

On average, female respondents rated the importance of recycling significantly higher than males did. Similarly, females reported a significantly higher rating of recycling impact on the environment than males.

Independent t-tests were also done to determine any significant difference in ratings of recycling importance and impact between students or faculty/staff at BSU. The following table demonstrates the mean responses of recycling importance and impact by students and faculty/staff.

Table 16

Mean Rating of Recycling Importance and Impact between Students and Faculty/Staff

	Importance	Impact
Students	1.60***	2.01
Faculty/Staff	2.06***	2.20

*significance at α=0.10

**significance at α=0.05

***significance at α=0.01

On average, faculty/staff ranked the importance of recycling significantly higher than students. There was no significant difference between student or faculty/staff ratings of recycling impact on the environment.

One-way ANOVA was used to determine any significant difference between age groups and rating of recycling importance and impact on the environment. The following tables represent the ANOVA results between age and recycling importance. The first table shows the average rating of recycling importance by each age group. The second table shows any significant differences between age groups.

Table 17

Mean Rating of Recycling Importance between Age Groups

	Importance
18-25	1.57
26-39	1.70
40-59	2.05
60+	2.68

Significance in Recycling Importance between Age Groups

	18-25	26-39	40-59
26-39			
40-59	**		
60+	***	**	*

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

The F-test on ANOVA showed significance between age groups at the 0.05 level. Respondents aged 40-59 rated the importance of recycling significantly higher than respondents aged 18-25. Respondents aged 60+ rated recycling importance significantly higher than respondents aged 18-25, 26-39, and 40-59. The levels of significance are reported in the second table.

The following two tables demonstrate ANOVA results between age and rating of recycling impact on the environment. The first table indicates the mean responses for each age group, while the second table indicates any significance between the age groups.

Table 18

Mean Rating of Recycling Impact between Age Groups

	Impact
18-25	1.96
26-39	1.93
40-59	2.24
60+	2.68

Significance in Recycling Impact between Age Groups

	18-25	26-39	40-59
26-39			
40-59			
60+	**	**	

*significance at α=0.10
**significance at α=0.05
***significance at α=0.01

Results of the F-test on ANOVA revealed significance between age groups at the 0.10 level. It was found that respondents aged 60+ ranked recycling's impact on the environment significantly higher than ages 18-25 and 26-39. The level of significance can be found in the second table.

Results of the correlation coefficient test done between the importance and impact variables showed significance at α=0.01. The Pearson Correlation value for importance was 1, while the Pearson Correlation value for impact was 0.649, meaning that respondents who ranked recycling importance highly would tend to rank recycling impact highly as well, and vice versa.

Discussion

Overall the hypotheses of this study were met with the findings that convenience of receptacles, belief in the benefits of recycling, and the presence of a local recycling program were the top factors influencing recycling behavior and that positive attitudes toward recycling importance and impact were found.

Respondents' Recycling Behavior

Consistency in responses was verified after cross referencing respondents' answers to *how frequently do you recycle* and *do you recycle now*. The mean response for each question was 2.86. Respondents reported rarely recycling at their homes while growing up, but reported they plan to recycle whenever possible in the future. This indicates an increase in recycling behavior and positive attitude over time.

Knowledge of recycling was not reported as a top influencing factor by respondents, but in their study, Hornik and Cherian found internal facilitators such as knowledge and awareness of recycling were most likely to predict recycling behavior (Hornik, 1995). They also found that social motivators were ranked second highest, however respondents in this study reported social influence lowest (Hornik, 1995). This discrepancy could be explained because only one brief question on my survey dealt with social influences, as opposed to several questions in Hornik and Cherian's study. It could also be that respondents aren't as consciously aware of the social pressures that influence their recycling behavior.

In congruence with the study done by Knussen and Yule, inconvenience or no recycling program present were the factors most likely to decrease recycling behavior (Knussen, 2008). They found that the more effort required the less likely respondents were to recycle (Knussen, 2008).

It was often found that middle aged people recycled significantly more frequently and more products than young people. This result is supported by Meneses' study which found that the further respondents were from middle aged, the lesser burden they bore of the recycling role (Meneses, 2005). People of working age were more likely to recycle because of responsibility factors such as homeownership (Meneses, 2005).

A surprising result of this study was that respondents aged 40-60+ reported recycling more at home growing up than respondents aged 18-39. This was not expected, as today there is more information on recycling and available programs than there was several decades ago. A possible explanation of this result would be to consider the physical recycling roles of respondents while growing up; younger people tend to bear a lesser burden of the recycling role in the household than middle aged people (Meneses, 2005). Also, behaviors change generationally. Older respondents are more likely to have grown up during the energy crisis or a U.S. war, when recycling and reuse of materials was essential.

Although future plans to recycle did increase overall, another surprising result was that respondents aged 40-60+ reported that they planned to recycle significantly more frequently in the future than respondents aged 18-39 did. It is surprising that with increased education and social awareness today, younger people did not report a higher planned recycling frequency. Perhaps recycling wisdom comes more from experience.

Respondents' Attitudes Toward Recycling

There was an overall positivity found in attitudes toward recycling. It was found that females tended to rate the importance and impact of recycling more highly than males. This could have to do with the fact that females often bear the most burden of the recycling role (Meneses, 2005), and therefore believe in recycling more strongly.

Faculty and staff tended to rate recycling importance significantly higher than students, but there was no significant difference in their ratings of recycling impact. An understanding of the impacts of recycling seemed to be constant. Factors increasing the faculty/staff's tendency to rate recycling importance more highly could include factors such as an increased average age and level of responsibility (Meneses, 2005).

Study Limitations

One of the biggest limitations to this study was that surveys were optional. Perhaps those already interested in recycling were more likely to participate in the survey which would skew results toward positive support of recycling. Although there was a strong attempt to be sure of clarity, several of the survey questions were subject to some personal interpretation, especially when dealing with a range of possible responses. It is quite possible that respondents interpreted questions differently, which could cause some inaccuracy in results.

Also, only a select number of options were laid out for each question, ideas could have been put into the respondent's head, and conversely, respondents might not have been able to specifically indicate a response other than what was offered in the survey question. It would have been interesting to allow a fill in option for respondents that chose "other" as a response to certain questions to know more specifically what products were being recycled, etc. It would also have been interesting to ask respondents whether they lived on or off campus, as this could affect the number of opportunities surrounding them to conveniently recycle.

Another study limitation is the likelihood of a type one error after doing several independent t-tests for statistical analysis. The bonferroni post hoc test was used in an effort to reduce the likelihood of a type one error occurring. Re-coding survey responses from the *always* to *never* scale into values of 4 though 0 could also pose some inaccuracy, as this transformed an ordinal variable to an interval variable.

Conclusion and Recommendations

Members of the BSU population have shown their commitment to recycling with 94.1 percent of respondents reporting recycling at least occasionally, compared with the national average of around 75 percent. Recycling receptacles on the BSU campus can be found on each floor of the residence halls, and next to almost every garbage can found on the academic side of campus. Large recycling containers are located near the campus dumpsters. There are many opportunities for recycling on campus, but for those living off campus the story may be different.

A curbside residential pickup service was offered free of charge until the summer of 2007, when the city of Bemidji decided to discontinue the service, commented a Waste Management employee. The cost of transportation and insurance needed for operating the vehicles got too high and it became uneconomical to offer the service in the county. Residents do have the option to pay a fee and still have their recycling picked up by the waste service; however few decide to do this or are unaware of this option.

Several community members were unhappy when the service was terminated and have admitted that their recycling behavior has lessened because of it. A graduate of BSU, Trevor Plendl, decided to take matters into his own hands. Plendl started giving bins to friends and community members living near the BSU campus, which they could put recyclables in. He founded the company Plendl Environmental, L.L.C., charging 5 dollars per month for his recycling pickup service.

Today, residents are required to drop their recyclables at the proper sites located throughout the county. Recyclables are then picked up periodically by Waste Management. This method of pick up is called a bring system or on-street collection facility. While the program is much cheaper to operate than a curbside pickup service, it is much less successful in the amount of materials recovered.

In 2009, the Minnesota Pollution Control Agency reported that Beltrami County collected 8,621 tons of recyclables compared with 23,123 tons which were sent to landfills or a resource recovery incinerator. The recycling rate was then about 27 percent. The county is required by law to recycle 25 percent of its municipal waste at minimum. This is quite a bit lower than the 50 percent recycling rate in Minnesota overall.

Economic costs have played an important part in Beltrami County's decision making with respect to residential recycling programs. Being such a large and rural county, funds have sometimes been insufficient in providing the most convenient methods of waste recycling that would normally be found in more urban areas.

A recycling study released by the United States Government Accountability Office in 2006 revealed that convenience, financial incentives, and education were the top three factors that would help promote the success of recycling programs. Survey participants identified similar factors that would increase their recycling likelihood including, convenience, belief in the benefits of recycling, and personal interest.

It is clear that the convenience of recycling programs is a key factor to their success. The government could help increase the accessibility of recycling with more recycling legislation and by requiring permanent recycling programs. Common financial incentives such as refuse fees but no fee for recyclables could also be increased. Businesses, industries, and consumers need to consider purchasing more products that contain recycled material in order to expand the market for recyclables.

No matter the technique, there is a certain level of public participation and interest that is needed for recycling programs to work. The spread of recycling education and awareness would be a good way to inform people on the benefits and importance of recycling. An increase in public interest would lead to a demand for more convenient recycling services, and therefore an increase in post-consumer recycling behavior.

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Appendix A

The following shows examples of each survey question seen by the survey participants. Numbers used in data re-coding are represented in quotations. Numbers in parentheses represent the percent of respondents who chose that answer.

Demographic Information:

Age:
□ "1" 18-25 (30.7)
□ "2" 26-39 (22.2)
□ "3" 40-59 (40.0)
□ "4" 60+ (7.0)

Gender:
□ "1" M (44.4)
□ "2" F (55.6)

BSU Affiliation:
□ "1" Student (42.6)
□ "2" Faculty/Staff (57.4)

General Information:

How frequently do you recycle?
□ "4" Always (16.3)
□ "3" Whenever possible (61.5)
□ "2" Occasionally (16.3)
□ "1" Rarely (4.1)
□ "0" Never (1.9)

What products do you recycle? (check all that apply)
□ Paper (91.5)
□ Aluminum (89.3)
□ Glass (81.5)
□ Electronics (45.6)
□ Batteries (38.5)
□ None (2.6)
□ Other (29.6)

Where do you actively recycle? (check all that apply)
□ Home (85.6)
□ Work (74.8)
□ School (45.9)
□ Other public areas (60.0)
□ None (1.9)

Where have you learned about recycling? (check all that apply)
□ At home (64.8)
□ At school (58.5)
□ At work (58.5)
□ From friends or peers (49.6)
□ Other (33.3)
□ None (1.5)

Did you recycle at home growing up?
□ "4" Always (8.5)
□ "3" Whenever possible (22.6)
□ "2" Occasionally (25.2)
□ "1" Rarely (21.1)
□ "0" Never (22.6)

Do you recycle now?
□ "4" Always (18.5)
□ "3" Whenever possible (58.1)
□ "2" Occasionally (16.7)
□ "1" Rarely (4.4)
□ "0" Never (2.2)

Will you recycle in the future?
□ "4" Always (20.7)
□ "3" Whenever possible (65.6)
□ "2" Occasionally (10.7)
□ "1" Rarely (2.2)
□ "0" Never (0.7)

What factors *increase* your likelihood to recycle? (check all that apply)
□ Convenient recycling receptacles (90.7)
□ Clear labeling of receptacles (65.2)
□ Presence of local recycling program (75.6)
□ Family/roommates/peers recycle (29.6)
□ Knowledge about recycling (47.0)
□ Personal interest in recycling (60.4)
□ Belief that recycling has benefits (78.9)

What factors *decrease* your likelihood to recycle? (check all that apply)

□ Inconvenient recycling receptacles (72.6)
□ Unclear labeling of receptacles (40.4)
□ Absence of local recycling program (68.5)
□ Family/roommates/peers don't recycle (14.8)
□ No knowledge about recycling (8.5)
□ No personal interest in recycling (10.7)
□ Belief that recycling has little or no benefits (18.9)

Rate the importance of recycling to you

□1	□2	□3	□4	□5	□6	□7
Not important			Neutral or unsure			Very important
"-3"	"-2"	"-1"	"0"	"+1"	"+2"	"+3"
(2.2)	(2.6)	(0.7)	(5.6)	(18.9)	(29.6)	(40.4)

Rate the impact you believe recycling has on the environment

□1	□2	□3	□4	□5	□6	□7
Negative impact			No impact or unsure			Positive impact
"-3"	"-2"	"-1"	"0"	"+1"	"+2"	"+3"
(1.5)	(1.1)	(1.9)	(4.1)	(16.7)	(20.7)	(54.1)

Appendix B
Survey Instructions

Dear BSU student, faculty, or staff member,

You are invited to participate in an online survey regarding recycling behaviors at BSU. The survey is part of my undergraduate thesis project. It should take you 2-5 minutes to complete. Responses will remain completely anonymous. Results will be available at the 2011 Student Achievement Conference or in the Environmental Studies Department. If you would like to participate please click the link below.

http://www.surveymonkey.com/s/38XLGQJ

Your participation is greatly appreciated!

Sincerely,

Kaitlin Boutelle
BSU Senior - Environmental Studies

Questions or concerns? Please email me at kaitlin.boutelle@st.bemidjistate.edu

Informed Consent Form

The purpose of this study is to obtain information about the recycling behaviors of Bemidji State University students and staff members. The survey is part of an undergraduate research project by Kaitlin Boutelle.

Risks may include reluctance to give out demographic and behavioral information or possible embarrassment about responses.

Your participation will aid in accurate representation of BSU's attitude toward recycling. By participating you may also gain satisfaction from your opinions being heard.

Responses will remain completely confidential. You may decline to complete the survey at any point in time.

Debriefing

THANK YOU! Your participation in the survey is significant and greatly appreciated.

The purpose of this survey is to understand the attitudes toward recycling in the BSU community. It is expected that most participants will have an optimistic attitude toward recycling, but convenience is what will ultimately determine a person's actual recycling behavior.

Results will be available in the fall of 2010, in the Environmental Studies Department. Also, a presentation of the results can be viewed at the Student Achievement Conference in April 2011.

If there are any further questions please contact me, Kaitlin Boutelle, at kaitlin.boutelle@bemidjistate.edu, or Dr. Fu-Hsian Chang in the Environmental Studies Department at (218)755-4104. Adverse effects from this study are not expected but should you experience this please contact Dr. Chang or the Student Center for Health and Counseling at (218)755-2053.

Thank you for participating!