

Case Study of a Project for First-Year Students that Integrates Research and Community Service

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Abstract

Over the last 20 years, recycling programs have developed throughout the United States and internationally. However, once the “recycled” material is placed at the curbside or brought to the recycling center, what happens next? Researching and describing recycling was the project aimed at providing first-year engineering students a “window on research”. The students were tasked to develop a poster document and presentation to use to inform community policy makers and citizens on the recycling behavior in Massachusetts. Project objectives were to introduce students to the technical and non-technical aspects of recycling and/or reusing waste materials as well as to introduce students to the “process” of research.

This paper describes the “Windows on Research” advising program used at Tufts University and the specific case of a research project on recycling in Massachusetts used in the program. Research process and results are presented, and the show that simple relationships between community and recycling characteristics may not adequately explain recycling behavior. This paper also discusses issues involved in using aspects of community-service to increase student interest in participating in research at this early stage in their academic careers.

Introduction

Tufts University has a number of unique advising program for entering first-year students. One of the options is “Window on Research” course which links a small group of students with faculty advisor who will expose the students to his/her research. During the Fall 2003 semester, the author lead such a “windows on research” effort that was focused on reuse options for waste materials. The objective of the course was two fold:

1. Introduce students to the processes involved in research. Specifically, it was expected that the students would be involved in hypothesis development, data collection, analysis, and synthesis.
2. Provide a common meeting time for student advising.

This paper presents the results of this advising program as a case study. The advising program is briefly described and specific components of the developed “course” presented. The research process and its results are also presented and discussed. The use of community service to create a more engaging research atmosphere is also discussed.

Window on Research Advising Program

Windows on Research is only one advising option that incoming first-year students may choose to participate in at Tufts University. Typical, advisors will have a small group of students (10 or less) and meet once a week during the semester to work on a research topic that the advisor is involved in or wishes to explore. Students receive a pass/fail, one-half course credit if they choose to participate in the “Windows on Research” advising course.

For this case study, the project was to research how waste materials are being, or can be, reused in Massachusetts. In addition to technical aspects of recycling, the project exposed students to the non-technical aspects of problems. Hopefully, the students would be able to see how economic, social and political factors influence a community's waste handling processes. It was hoped that exposure to non-technical aspects would further engage the students while doing the research. The final deliverable was for the students to develop a poster to be presented at a Spring 2004 symposium.

However, it was also hoped that the students would develop a document that would inform the various stakeholders (e.g., community policy makers and citizen boards) about reuse options for recovered materials in their community. The document would provide the following:

- Rationale behind recycling programs
- Enhanced waste utilization
- Reduced waste disposal costs
- Focus on engineering reuse options
- Also show non-engineering reuses (e.g., waste to energy)

Specifically, this final document would summarize the collected data and research from affected communities and provide fact sheets on recovered materials (what is it, how much, how reused, etc.). Components of these fact sheets would include:

- Historical MA waste disposal/handling
- Recycling benefits
- Waste stream characteristics – stats and data
- Recovered material characteristics – stats and data
- Existing markets for recovered wastes
- Engineered reuse options

However, given the time constraints of the course (one meeting a week with little student involvement outside of class meetings), development of this final document was not attempted.

Format of “Course”

In addition to research review, the “course” meetings were utilized in a variety of ways as described below.

Instructor lectures - The author presented two lectures on US and Massachusetts recycling programs and the characteristics of these programs. These lectures were meant to provide a general overview of recycling and reuse.

Data collection methodologies - Students had to attend a one-hour short course on the use of the university library and electronic resources. The course was led by the university library's reference staff who specializes in engineering resources.

Laboratory experiments - Two class period was used for the students to mix concrete (mortar) specimens and create 2-inch cube specimens. The sand-like used in the specimens was a synthetic aggregate created from waste plastics and coal fly ash. The students were able to test the specimens for 28-day strengths and examine test results as part of a later class period.

Student advising - At least two class periods were used for general academic advising. This included reviewing the add/drop policy and dates, registering for courses, etc.

Research Component

The research effort involved collecting and synthesizing data on the recycling behavior of communities in Massachusetts. In brief, recycling in the state is controlled by each of its 351 towns and cities. Each community annually reports their waste handling and recycling information to the Massachusetts Department of Environmental Protection. Therefore, through research (i.e., data collection and synthesis), it was possible to examine the hypothesis that simple relationships between community demographics and recycling and reuse characteristics exist that would describe recycling behaviors in Massachusetts.

Data collection was divided into three tasks areas – community information (demographics), recycling information, and reuse options. Each of these areas is described in more detail below.

Community Information

Students needed to acquire information on the demographics of MA communities. Information needed include, but was not limited to; age, race, gender, income, personal spending, education level, high school graduation rate, unemployment rate, job types, employee/industry base, etc. This information should help in profiling the recycling habits of the various MA communities. For example, high unemployment communities could be grouped separate from low unemployment, using the state's average unemployment rate as the delineator.

Recycling Information

Students collected available data on the recycling rates of the towns and cities in Massachusetts. If possible, students also tried to collect historical records (factual and anecdotal) of the recycling efforts in MA. This data collection included yearly recycling rates for each MA community for as far back as records have been kept. If possible, the developed database would also list what is recycled (plastics, metal, paper, tires, etc.) and the quantity of these recycled materials. Information on recycling goals and whether these goals have or have not been met were also to be explored.

Reuse Options

This task focused on evaluating how recyclables are reused. Specifically, information was needed as to where recovered materials go for the different communities. Students were expected to contact recycling coordinators of Massachusetts towns and cities as well as businesses which provided recycling services.

For each of these areas, students were to explore all available resources, including library and personal contacts with state and community officials. As data was collected, the class would discuss the results and develop an appropriate presentation.

Research Results

Demographic data was collected for all 351 Massachusetts towns and cities (communities). Such data included population (2000 census), population density (people per square mile), income per capita, and unemployment rate. Recycling data collected included community recycling rates for 2002 and whether a community recycled via curbside pick-up or a drop-off center(s). However, only 291 of the 351 communities had available data on their recycling rates while data for only 335 could be found regarding their use of curb-side versus drop-off recycling participation.

In addition to these characteristics, communities are separated into one of seven kinds of community (as described by the Massachusetts Department of Revenue). Kinds of Community (KOC) are

- Urbanized Center (KOC 1)
- Economically Developed Suburb (KOC 2)
- Growth Community (KOC 3)
- Residential Suburb (KOC 4)
- Rural Economic Center (KOC 5)
- Small Rural Community (KOC 6)
- Resort, Retirement, Artistic (KOC 7)

These various parameters were used in developing relationships between community demographics and recycling behavior. Students were assigned to develop graphs of particular one-to-one relationships to test the hypothesis.

Figure 1 illustrates the relationship between the kind of community and recycling participation method. A trend can be noted that curbside recycling programs are preferred in urbanized communities while drop-off recycling programs are preferred in more rural or resort communities. However, Figure 2, which shows a relationship between per capita income and recycling rates indicates no obvious trend. By examining these and other relationships, it became obvious that most simple, one-to-one relationships would not show the complete picture of the recycling behavior in Massachusetts. Thus, the hypothesis was proven false with explanation of the recycling behavior in Massachusetts requiring more sophisticated analyses, possibly with more data and using multi-variant analysis methods.

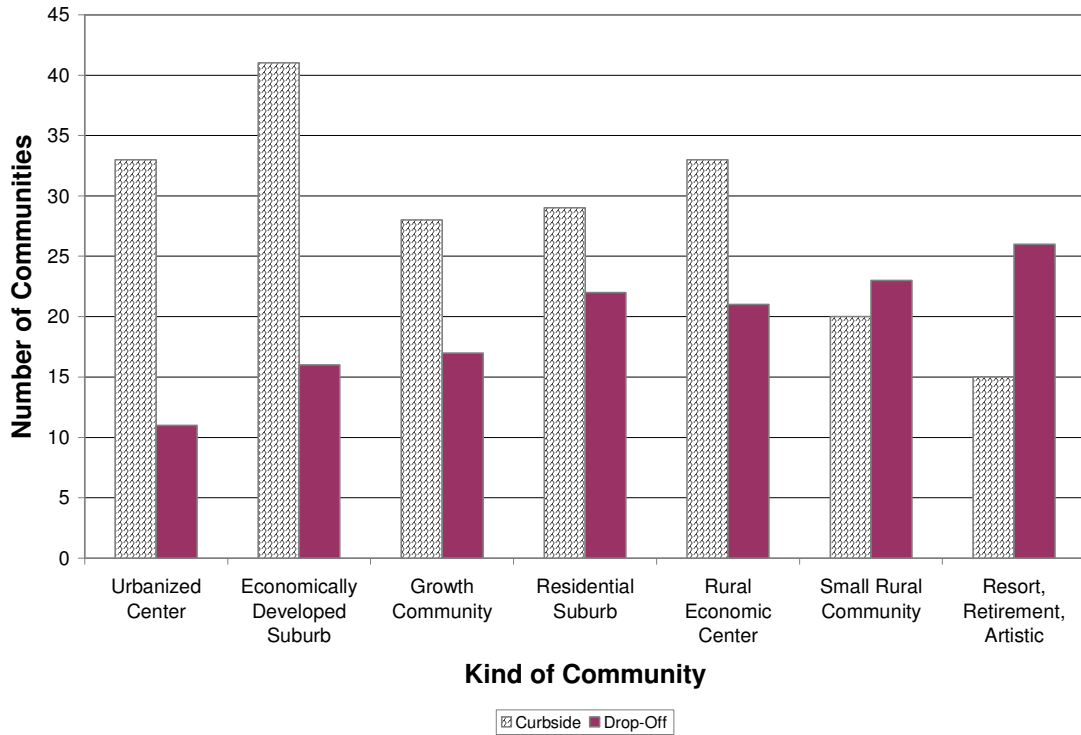


Figure 1 Comparison of Kind of Community and Recycling Participation Method for Communities in Massachusetts

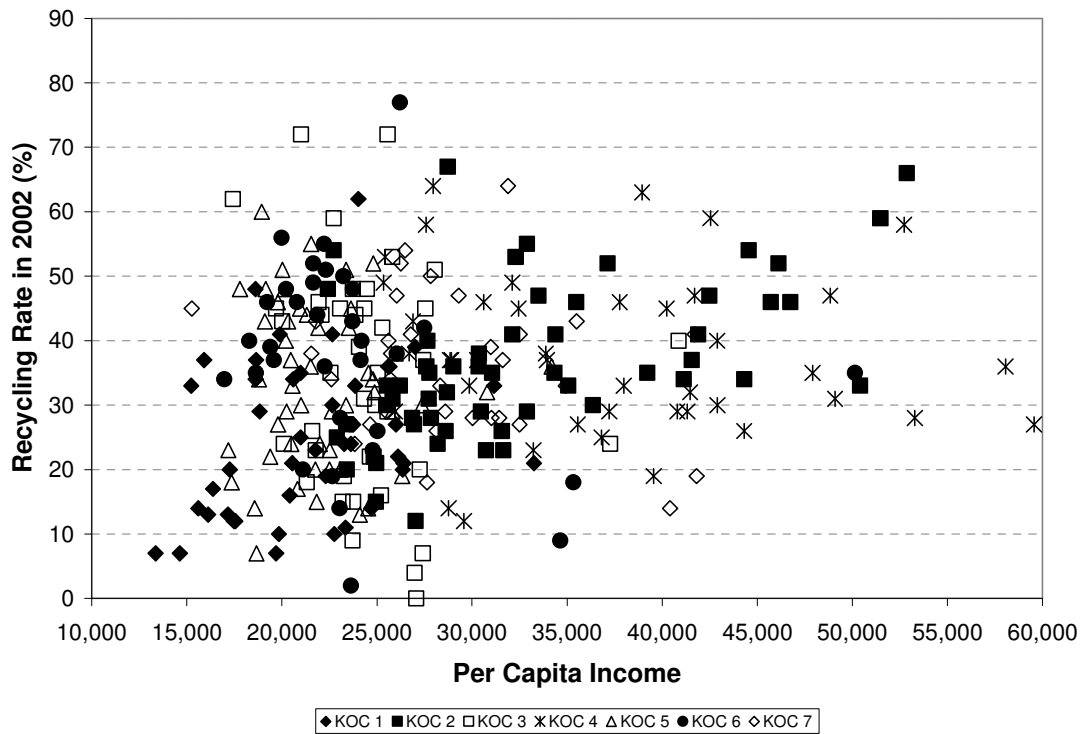


Figure 2 Comparison of Per Capita Income and Recycling Rate in 2002 for Massachusetts Communities

Discussion and Conclusions

Though this course was to provide a “window” to potential research on recycling, the author now realizes that the tasks outlined, if fully realized, would constitute a complete graduate-level research effort. So, while the intention of the project was to develop a final “document” for use by various stakeholders involved in recycling and waste management, the final results fell far short of this goal. However, the results of the work did lead to a data set that could be used and further enhanced by a more robust research effort on recycling that would lead to such a document.

One of the difficulties with the concept of “Windows on Research” is that first-year students, who have essentially no experience with research or post-secondary academics, are expected to actively participate in research. While tasks can be devised to make students feel as if they are contributing to a research effort, true participation in a research effort requires students to be *engaged and informed* about the research topic and to have a desire to seek new knowledge on that topic. The format of the course (one, weekly, hour-long meeting for a course with little academic credit value) makes the prospects for complete student engagement more daunting and difficult.

To help overcome this hurdle, it was hypothesized that couching the research within a community service effort would make it more appealing to students and thus increase their interest and desire for research participation. While the author still believes that this would still be true, it is difficult to see how using the “carrot” of community service impacted the effort put forth by the students in this case. While the students were interested in the topic, the lack of time available to participate in the research and the “perceived” low value of the research to their “college livelihood” made the experience less influential.

Future uses of the Windows on Research advising process by this author would spend less time in class on advising and more time on data synthesis and presentation. Thus, hopefully more fully engaging the students in the research topic and leading to a more fruitful experience for them. In addition, the plans to assess the student’s reaction to the project once the poster presentation is completed.

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Dr. Swan is the Chair and an Associate Professor in the Civil and Environmental Engineering (CEE) department at Tufts University. His current interests are the use of service learning as pedagogy, reuse of recovered or recyclable materials, and environmental site remediation.