Students’ Behavior towards Energy Conservation and Modes of Transportation: A Case Study in Mahasarakham University

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Abstract

To change students’ behavior to the energy-conservative modes of transportation, the study investigates their traveling behavior and factors influencing environmental attitude and behaviors towards the energy conservative modes of transportation. Utilizing the Mahasarakham University as a case study, the research took the scenario study approach by setting up three hypothetical conditions—Ridesharing or Carpool, Car-free day, and Ribbon-Bicycle projects. Questionnaire survey was conducted with 250 students from six faculties. Results from the study will be of benefit to the university’s energy-conservative program.

Keywords: Environmental behavior; energy conservation; traveling pattern.

1. Introduction

The current global energy crisis urges public and private sectors to find the energy efficient solutions to meet the needs of the current generation and the next one. In particular, to preserve fossil fuel energy,
the changing modes of transportation from the personal to public modes have become recognized in literatures.

Mahasarakham University (MSU), as one of the newly established campuses in the region, has been growing not only in the developmental aspect, but also in the number of students and staff. As a part of becoming Green University, the MSU policies and plans have been recently aimed toward the green university based on UI Green Metric World University Ranking (Universitas Indonesia, 2011). The metric consists of five major criteria namely, (1) Setting and Infrastructure, (2) Energy and Climate Change, (3) Waste, (4) Water, and (5) Transportation. In terms of transportation criteria, a university policy relating to transportation should be designed to limit the number of motor vehicle used on campus. Public buses should be available within the campus whether free or paid. A bicycle and pedestrian policy on campus should reflect the extent to which bicycle use or walking is supported. In this light, MSU has launched many plans and projects to increase their performances. Ribbon-bicycle project is among the projects launched in the last two years. The project was unsuccessful and not popular among students. People on the campus prefer to use personal cars or motorbikes for their daily traveling to and from the campus. With the growing number of students, fuel energy consumed by personal mode of transportation has been increasing yearly.

The research aims to study the current students’ traveling behavior. How can the students be encouraged to change their behavior towards the energy-conservative transportation? Factors influencing environmental attitude and their behaviors towards the energy conservation and modes of transportation were also examined. Using Mahasarakham University as a case study, the research took the scenario study approach by setting up three hypothetical conditions—Ridesharing or Carpool, Car-free day project, and Ribbon-Bicycle project. Energy reduction caused by changing travel behavior regarding different scenario is compared.

2. Literature Review

2.1 Energy and the Environment

Fossil fuels are the most important source of energy in transportation. The tremendous increase in energy demand is not only diminishing the non-renewable resource, but it also escalates the emission of greenhouse gases (GHG) and causes global warming. It is reported that the global demand for energy grows by one-third between 2010 and 2035 with fossil fuels accounting for over one-half of the increase in total primary energy demand (IEA, 2011). The majority of the demand comes from the Asia region, especially China and India accounting for 50% of the growth (IEA, 2011). The trends also show that carbon dioxide emission has rebound to a record high. As global oil production decrease, renewable energy and alternative energy sources will become a crucial energy source in both developed and developing world.

2.2 Environmental Behavior

Environmental behavior has been discussed in many aspects. What make individual change his/her behavior towards sustainable lifestyles? The theory of Planned Behavior assumes that attitudes have a causal impact on behaviors through the mediation of behavioral intention (Godin & Kok, 1996). This intention is determined by attitudes, subjective norms, and perceived behavioral control (Mannetti et al, 2004). Homburg and Stolberg (2006) discussed an adapted theory of cognitive stress that explains how environmental stress could lead to pro-environmental behavior. The environmental stressors can be defined as “…physical and social environmental conditions that an average person would perceive as
actually or potentially threatening, damaging, harmful or depriving” (Homburg and Stolberg, 2006 refers to Lepore and Evan, 1996, p.350). Those stressors include climate change, environmental pollution, accidents or disasters.

In terms of energy conservative behavior, a number of past researches attempt to find solutions to decrease the demand, particularly at the household level (see reviews by Markowitz and Doppelt, 2009). Many had focused on changing traveling behavior towards the conservative mode of transportation such as riding a bike, taking public transport, and sharing a ride. The reduction in energy consumption and GHG emission as results of travel behavioral change had been investigated by Markowitz and Doppelt (2009). Researchers have studied any effective approaches and methods for reducing driving demand. The study of Foxx and Hake in 1977 (one of the earliest study on travel behavior) showed that changing college students’ driving behavior needs a combination of reinforcement and incentives including cash bonuses, free oil changes, etc. With a small sample of student drivers, the study found that approximately 20% of daily mileages were decreased over the course of a month (Markowitz and Doppelt, 2009 referred to Foxx and Hake in 1977).

Dissemination of knowledge and information is conventionally recognized to be an effective strategy to change people’s behavior. Zografakis et al (2008) studied the effect of disseminating knowledge and information to a group of students and their parents in Greece. They found that the sample group changed their behavior to a more energy efficient one, after participation in the energy education project and getting the relevant information (Zografakis et al, 2008). Energy-related information and education among students could create multiplier effects among their peers and other people such as family, relatives and neighbors. Social influence is considered as a key factor to behavior change in transport by Axsen and Kurani (2011). Individuals could change their value systems and priorities in a relatively short amount of time if they are given the right social conditions. Social interactions with family members, friends, and colleagues affected one’s lifestyle, purchase decisions, etc (Axsen and Kurani, 2011). Conventional policy should not only aim to change people behavior through the information, it should also understand how individuals interact with their friend and family, and how that behavior can change (Axsen and Kurani, 2011).

Environmental attitudes have also been recognized among the factors affecting people behavior. The difference in contexts in which individuals live and work can contribute to their environmental attitudes. Many studies focused on young people and learning how environmental attitudes developed and the causes of their attitude variation (Pauw and Petegem, 2010). The contextual factors including demographic and socio-economic factors, cultural setting, and living conditions can influence and shape people’s attitudes and behaviors. Age and gender were among the interesting factors influencing environmental attitudes (Pauw and Petegem, 2010 referred to Arcury et al, 1987). It was found that younger people tend to possess more environmentally positive attitudes than older people. Females are more concerned about the environment than males.

This paper focuses on the current traveling behavior of students. Factors affecting their environmental knowledge, attitudes and travelling behavior are also investigated. The research set up three hypothetical conditions—Ridesharing or Carpool, Car-free day project, and Ribbon-Bicycle project. The hypothetic framework of the relevant factors and their relationships are summarized in Fig. 1.
3. Methodology

Utilizing the Mahasarakham University’s new campus in Khamriang Sub-District as a case, the study took the scenario study approach by assuming three hypothetical conditions—Ridesharing or Carpool project, Car-free day project, and Ribbon-Bicycle project. The stratified random sampling technique was used to classified students in three groups regarding to their study areas namely, Science and Technology, Health Science, and Humanity and Social Science. Six faculties from these three areas were randomly selected. The study collected information by means of questionnaire survey with 250 students who were randomly selected from the six faculties. The questionnaire consists of four parts—(1) demographic and socio-economic information; (2) basic environmental knowledge and energy related issues; (3) current traveling patterns and driving behavior; and (4) participation in the energy-conservative mode of transportation based on the three scenarios. Data retrieved from the survey were analyzed by using statistics analytical package (SPSS for Windows). Data tabulation and statistical analysis are accomplished to established based line ramifications. The amount of fuel that could be saved from different scenario is calculated and compared.

4. Results and Discussion

1.1. Students’ Traveling Behavior

Mahasarakham University is located in a college town of Northeast Thailand, also known as Isaan. The university has two major campuses; one in Muang district (known as the old campus) and another in Khamriang Sub-District (known as the new campus). These two campuses are approximately 7 km. a part. Students need to travel back and forth between these two areas as well as their residences and the campuses. Motorbike becomes the most popular mode of transportation since it is convenience, economical and less fuel needed compared to a car. There are only two lines of public transportation (in a form of pick-up car) passing by the university (Fig. 2). Most of interviewed students were living outside the campus (71.6 percent). The rest of samples were in the campus’s dormitories (28.4 %).

Data from the survey found that most students travel to the campus by their personal motorbikes (68.4 % of the sample students). Only 10.8 percent uses public transit and 1.2 percent drive personal cars. Students living in the new campus might use bicycles and walk to buildings (9.6 %) (Table 1). In terms of trip generation, the study found that most students make their trips (back and forth) to the campus by their own vehicles every day and more than once a day (60.0 %) followed by the group that travel once in every 2-3 days (28.8 %). On the other hand, approximately 40 percent had never used public
transportation. It was found that a small group of students used public transit every day (11.2%) (Table 2). Using motorbike has become students’ riding habit. It is very surprised to find that students preferred to use motorbikes to their destination in the walking distance, where they could have walked or ridden bicycles.

![Fig. 2. Modes of Transportation on the Campus](image)

Table 1. Modes of transportation

<table>
<thead>
<tr>
<th>Mode of transportation</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Transportation (a pick-up car)</td>
<td>27</td>
<td>10.8</td>
</tr>
<tr>
<td>Private Vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Motorbike</td>
<td>171</td>
<td>68.4</td>
</tr>
<tr>
<td>- Car</td>
<td>3</td>
<td>1.2</td>
</tr>
<tr>
<td>Walk/ Bicycles</td>
<td>24</td>
<td>9.6</td>
</tr>
<tr>
<td>Private and Public Transportation</td>
<td>25</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>250</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 2. Trip generation to the campus by privately-owned vehicle

<table>
<thead>
<tr>
<th>Trip generation</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>One trip per day (back and forth)</td>
<td>72</td>
<td>28.8</td>
</tr>
<tr>
<td>More than one trip per day</td>
<td>80</td>
<td>32.0</td>
</tr>
<tr>
<td>One trip in 2-3 days</td>
<td>72</td>
<td>28.8</td>
</tr>
<tr>
<td>One trip per week</td>
<td>4</td>
<td>1.6</td>
</tr>
<tr>
<td>Never</td>
<td>22</td>
<td>8.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>250</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
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4.2. Knowledge on Environment and Energy Conservation

In the second part of the questionnaire, the study examined the environmental knowledge of students based on three categories of environment and energy conservation issues including (1) basic knowledge on energy sources for transportation (2) knowledge on fossil fuel consumption and the environmental impact, and (3) energy conservation in transportation. Seven questions regarding to those three issues were used to evaluate students’ knowledge. The survey shows that the gender, students’ majors and year of education did not demonstrate the significant differences in the level of environmental knowledge. However, the students showed the good overall attitude towards the issues of energy conservation and had high scores on the basic knowledge regarding energy consumption. Approximately 83 to 98 percent of students chose the correct answers to each question. Most of them (72%) could answer all questions right (Fig. 3).

![Fig. 3. Basic knowledge on environment and energy-related issues](image)
4.3. Attitudes and Behavior towards Energy Conservative Mode of Transportation

The research studied attitudes and willingness of students to change their traveling behavior towards the more energy conservative choices of transportation. The study used three scenarios: ridesharing or carpool, car-free day, and ribbon-bicycle programs to create the differences in hypothetical conditions affecting students’ attitudes and behavior.

(1) Ridesharing or Carpool: the concept of ridesharing referring to carpooling or vanpooling, in which vehicles carry additional passengers. It is considered one of the most cost-effective alternative modes to areas not well served public transit. For the carpooling, participants use their own automobiles and take turn on riding a car. Data show that about 40 percent of samples were driving alone and using motorbike as the main choice for traveling to and from the campus. Under this concept, the ridesharing could be initiated on the campus. However, in the case of most MSU students, it might be properly called “motorbikepool”.

It could be possible for rideshare if people have some experience travel with the others. The study found that most students used to share a ride with friends to the campus. Most of them do not express any problem traveling with the others. However, on the socio-cultural point of view, who they can share a ride with is the most important issue for the program. Students stated that they would only share their motorbike ride with the person they know. Most of the students chose to share a ride with a friend from the same faculty or department (33.6%), followed by the person they knew who lived in the same dormitory/place (23.1%), and friends from different faculties/departments (18.6%), respectively (Table 3). Students were aware of the benefit of ridesharing and most of them willing to participate in the program. There are reasons that make students do not want to participate including the issues of inconvenience, trustworthiness, and their safety, respectively (Table 3).

(2) Car-free day: set within this program, students have to leave their vehicle at home and travel with alternative modes, such as rideshare with friends, public transportation, and bicycles/walk. It was found that most students willing to leave their automobile at home at least once a week (47.6%) followed by twice a week (22.0%). They choose to travel with their friend’s vehicle (60.8%) and by public transportation (31.6%). Only a small number of students will travel want to go by bicycles or walk (7.2%) (Table 4). The convenient issue caused the most concern for participation.

(3) Ribbon-Bicycles: following the trend of green university, MSU has launched the bicycle rental project also known as “ribbon-bicycle project”. The university made an investment for buying he new set of bicycles. The rental points were located near the dormitories, so that students could rent them conveniently. The fee is super cheap, one Baht per day (30 Baht=1USD). The project has never been unsuccessful and not popular among students. The study investigated the reasons why the program was unsuccessful and how to get more students participate in the program.
The study found that more than 80 percent of sample students did not have bicycles of their own. It was surprised to find that a huge number of students had never heard about the Ribbon-Bicycle project before. Only 5.6 percent of the samples had rented the bike under this program. Nevertheless, students stated a good attitude toward riding bicycles and the ribbon-bicycle project. Most of them expressed their willingness to participate in the project. Approximately 34 percent did not want to participate in the project. The issues related to the inconvenience of using bike and the hot weather of the North-Eastern region are among the important reasons discourage students to riding bicycles. Other factors influencing the participation include the rental rate, the hours of rental service, and the condition of bicycles. Students also cared about the types and styles of bikes i.e. colour. Without taking students’ needs and constraints into account, the bicycles project will by no means be successful.

4.4 Estimate of Energy Consumption

With all the three scenarios, ridesharing (Carpool), car-free day, and ribbon-bicycle projects, the study estimates the amount of energy that could be reduced if students participate in each project. Data from the survey show that among the three projects, most students select the ridesharing as their first choice of willing-to-participate project (with the average rank of 1.69), followed by the car-free day project (1.96), and the bicycle project (2.35) (Figure 4). Factors influence their decisions include convenient issue, traffic condition, traveling cost and time, and accessibility to public transportation.

Data from the study showed that 68.4% of samples, which are 171 students, travelling to school by motorbike. If different portions of these students participate in one of the three projects, how much fuel consumption will be reduced? The study calculates energy used by motorbikes with both manual and automatic gear-shifting systems as showed in Table 5.

5. Conclusion

The study showed that most of the students preferred the convenient modes of transportation by choosing their personal cars over the public transportation. It was found that gender, age, year of study, and background knowledge did not demonstrate any significant relationship with energy-conservative attitude and behavior. Nevertheless, the study found that the locations of the students’ living places and their monthly allowance had significantly influenced students to participate in the three energy-conservative projects. Results from the study could be beneficial to the university’s energy-conservative programs. The energy conservative campaigns on the campus should consider students’ needs and
constraints as the key elements for the plans, particularly the one that involves changing students traveling behavior.

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