Travel Perception towards Uncertainties among Industrial Technology and Engineering Students: Inputs to Class Scheduling

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Abstract

Travel behaviors and travel patterns of different individuals vary. This study considers the travel perception of various industrial technology and engineering students of the Mindanao University of Science and Technology (MUST), Cagayan de Oro City, Philippines, in response to various travel uncertainties. Based on the students' preferences, the effects of travel uncertainties to their travel behavior and travel time allocation under various circumstances, such as major exams, class quizzes and regular classes, for various courses are considered. Preferences of students on various factors such as type of jeepney, jeepney's route, and behavior of jeepney driver, number of rides to take to get to school, among others, are investigated. Results show that the number of preferences considered by these industrial technology students and engineering students for their travel allocation varies according to their trip purpose and to the courses they are to attend. Moreover, a travel function model is then developed based on the preferences considered by these students when making travel decisions. Such results are valuable inputs for scheduling the various classes taken by technology and engineering students in order to optimize their learning process especially in Mathematics courses.

Keywords: Perception, Travel uncertainty, Travel preferences, Industrial Technology Students, Engineering Students

1. Introduction

Most researchers on traffic problems assume that travelers already know the actual traffic conditions even before they start traveling and that travel behavior is deterministic (Hendrickson and Kocur (1981), Henn and

Ottomanelli (2003), Lago and Daganzo (2007), Song, *et al*. (2010)). However, in reality, traffic condition is not perfect. Travel uncertainties really occur in the actual traffic system. Hence, the assumption that travel behavior is deterministic is not true in general.

In the Philippines, jeepneys are considered the most common means of transportation. Jeepney commuters will have to allocate some time waiting for a jeepney to arrive, or for the jeepney to have enough passengers for it to start moving. Moreover, jeepneys tend to stop at various points for passengers to board or alight.

Most students use jeepneys for their daily commute and thus have to experience various travel uncertainties. Daily travel times vary depending on the actual traffic conditions. Students will have to depend on their past experiences when deciding for their travel options. Travel perceptions are not always deterministic but are mostly affected by uncertainties.

Viti and van Zuylen (2004) considered the evaluation of the cost that travelers associate to the component of uncertainty in the travel time. They also studied the behaviors of travelers' response to uncertainty, assessing whether they make their travel decisions based on their past experiences or based on the traffic information they receive.

Lo, *et al*. (2006) presented a route travel time function which is the sum of the corresponding link travel time variables. Mathematically, their model is as follows:

$$T_r = \sum_a \delta_a^r \cdot T_a \tag{1}$$

where δ_a^r is the route-link incidence parameter whose value is 1 if link a is on route p, 0 otherwise, and T_a is the travel time. Correspondingly, the *travel time budget* associated with route r, is expressed as the *sum of the expected travel time and the travel time margin*, that is,

$$T_B = E\,(T_r) + \lambda\sigma_{T_r}, \tag{2}$$

where λ is related to the requirement on punctual arrivals, and

$$\sigma_{T_r} = \sqrt{\sum_a [\delta_a^r \cdot \mathrm{var}\,(T_a)]} \tag{3}$$

In this study, a face-to-face survey is conducted to determine and investigate the effect of travel time variability on route choice behavior. The survey is aimed at gathering information on the respondents' departure time choices given a travel time distribution for the travel and the start time of the event. The study, however, did not consider and discuss the factors affecting the travel decisions of the respondents.

In this study, different factors contributing to travel uncertainties are investigated and the travel perception of various industrial technology and engineering students of the Mindanao University of Science and Technology (MUST), Cagayan de Oro City, Philippines, in response to travel uncertainties, is considered. Moreover, the effect of travel uncertainties to their travel behavior and travel time allocation under various circumstances such as major exams, class quizzes and regular classes is also considered. A travel function model based on the preferences considered by these technology students when making travel decisions is developed.

This study focuses on how the students make their travel decisions when they are to attend or take an examination in Math courses such as college algebra, and plane and spherical trigonometry, and differential calculus; and in non-Math courses like study and thinking skills, new constitution, and Rizal's life, work and ethics. Generally, these courses are taken by first and/or second year students.

2. Factors contributing to uncertainties

In what follows, the various factors considered in the formulation of the travel budget function are presented. Various factors contributing to uncertainties have been identified and these are categorized into controllable or uncontrollable factors. The *controllable factors* (a_i) are those which travelers consider in order to satisfy their traveling preferences while the *uncontrollable factors* (b_i) are those which a traveler will have to experience or go through when using public commute. These factors are presented in Tables 1-2.

Table 1. Controllable factors affecting travel uncertainties.

Factors		Description
a_1	Jeepney routes	Various predetermined routes are being followed by jeepneys in Cagayan de Oro (CDO); hence travelers have various options to choose from.
a_2	Appearance of jeepney	Some travelers have preference over the form, appearance and added accessories/ features of jeepneys.
a_3	Personality of jeepney driver or collector	Some travelers have preference over the driver and collector's attitude towards passengers.
a_4	Jeepney comfortability	Some passengers tend to dislike sitting on the extension seats; hence will have to wait for the next jeepney.
a_5	Familiar "suki" jeepney	Some passengers prefer to ride on jeepneys with drivers already known to them.

Table 2. Uncontrollable factors affecting travel uncertainties.

Factors		Descriptions
b_1	Maximum traveling speed of the jeepney	Speed of jeepneys vary in CDO depending on routes (*some jeepneys travel relatively slow).*
b_2	Number of traffic lights/intersections with traffic enforcers that the jeepney will pass through.	The more traffic lights/ intersections the jeepney will have to pass through, the more stops it has to make and hence, the longer the travel time.
b_3	Number of rides needed to get to MUST from home.	Travelers requiring connecting rides/ transfer will have to spend some time before the next ride comes.
b_4	Frequency of stops that jeepneys make to pick-up and drop-off passengers.	Some jeepneys tend to make stops at various points to pick-up or drop-off passengers.

Corresponding to these preferences are the penalty values for each preference chosen depending on the origin of the respondent which are discussed in the next section.

3. Methodology

All freshmen and sophomore students of the College of Engineering and Architecture and the College of Industrial and Information Technology enrolled during the 1st semester AY 2009-2010 are considered as respondents of this study. The different origins of the respondents are grouped into clusters as shown in Table 3.

A face-to-face interview among randomly selected first and second year Industrial Technology and Engineering students of MUST has been conducted. Fifty (50) students from each cluster were included in the interview. The respondents are asked to choose which among the factors discussed above they consider when making their travel decisions. They are also asked to give their travel preferences given various situations such as when they are attending a regular class lecture, when there is a quiz scheduled or when it is exam week both for math or non-math courses.

Table 3. Various points of origin (in Cagayan de Oro City) of the respondents.

Cluster	Location
1	Bugo, Puerto, Agusan, Tablon, Baloy
2	Kauswagan, Bon-Bon, NHA, Bayabas
3	Bulua, Opol, Iponan
4	Macanhan, Balulang, Zayas, Xavier Heights, Pagatpat, Canitoan
5	Tagoloan, Villanueva, Jasaan, Balingasag
6	Patag, Carmen
7	Cugman, Gusa, Lapasan
8	Puntod, Macabalan, Consolacion
9	Macasandig, Nazareth

Corresponding to these controllable and uncontrollable factors are delays (measured in terms of time) for each preference chosen, which shall be referred to as penalty values. These values are obtained according to the different clusters which are the points of origin of the student respondents. These values are obtained through interviews and actual riding experiences of the respondents and researchers.

In what follows, the penalty values associated with each controllable and uncontrollable factor are presented. In Table 4, values for variable a_1 are obtained based on the time spent waiting for a preferred jeepney route, a_2 are based on the time spent waiting for a preferred a type of jeepney, a_3 are based on the time spent waiting for a preferred type of jeepney driver/collector, a_4 are based on the time spent waiting for a jeepney that you could sit comfortably, and lastly, a_5 are based on the time spent waiting for a familiar "suki" jeepney.

Table 4. Penalty values for controllable factors a_i.

Cluster	a_1	a_2	a_3	a_4	a_5
1	15	10	8	2	20
2	10	8	8	3	15
3	20	10	8	2	25
4	15	5	8	4	20
5	15	10	8	3	20
6	8	5	6	3	15
7	3	3	6	2	15
8	10	5	5	2	15
9	10	8	5	2	15

Similarly, values shown in Table 5 are obtained based on the preferences under the different clusters. Values of variable b_1 are obtained based on the time delay caused by the speed of the jeepney chosen for each route per cluster, b_2 are based on the time delay when passing through a traffic lights/intersection, b_3 are based on the time spent in transferring from the first ride to the other (waiting time), b_4 are based on the time spent when jeepneys have to stop to pick up or drop off passengers.

Table 5. Penalty values for uncontrollable factors b_i.

Cluster	b_1	b_2	b_3	b_4
1	3	8	0	15
2	5	15	5	5
3	4	20	3	5
4	8	8	5	10
5	3	8	3	8
6	8	15	2	8
7	5	5	2	5
8	8	5	2	15
9	8	5	2	10

In the real world, the penalty cost for each factors differ depending on the perception of the students and depending on the origins of the respondents. The values presented above are based on the students' response on which factors they consider when making their travel decisions and the computed early and/or late arrivals. These values have been validated through actual riding experiences by the researchers.

4. Results and Discussion

Figures 1–3 show the travel preferences of Industrial Technology students and the Engineering students from Clusters 1 to 9 in response to travel uncertainties when attending a regular class, sitting in for a class quiz or taking a major exam, for math courses.

It can be observed that the preferences considered by the Industrial Technology and Engineering students tend to diminish according to their trip purpose. For example, it can be seen from the Figures 1-3 that the number of preferences considered by the student respondents when attending a regular class is greater than the number of preferences considered for exams. Moreover, the number of students choosing particular preferences for each of the three scholastic activities tends to decrease in number as the activity becomes more important.

It should be noted that, in general, students give higher regard to exams, followed by quizzes, while least regard is given to regular class. For example, all industrial student respondents include jeepney comfortability in their travel preferences when attending a regular class in math. The number decreases to around 90 percent when there is a math quiz and then becomes only a little over 80 percent when there is a math exam. This means that the travel uncertainties which could be experienced by these students are reduced as the numbers of preferences are reduced. A similar behavior can be observed among engineering students.

However, it is interesting to note that, for mathematics courses, quite a number of industrial technology students include more preferences when making their travel decisions as compared to the engineering students in all three scholastic activities. For example, jeepney comfortability is a common choice among industrial technology students when attending a regular class, taking a quiz or an exam in mathematics courses while only a few engineering students consider this preference when attending a regular math class or taking a quiz and none of the respondents considers this preference when there is a math exam. The inclusion of jeepney comfortability in the travel preference of students actually means that they will have to spend more time waiting for the next jeepney so as to sit comfortably but which in turns contribute to a longer time spent travelling from their origin to MUST.

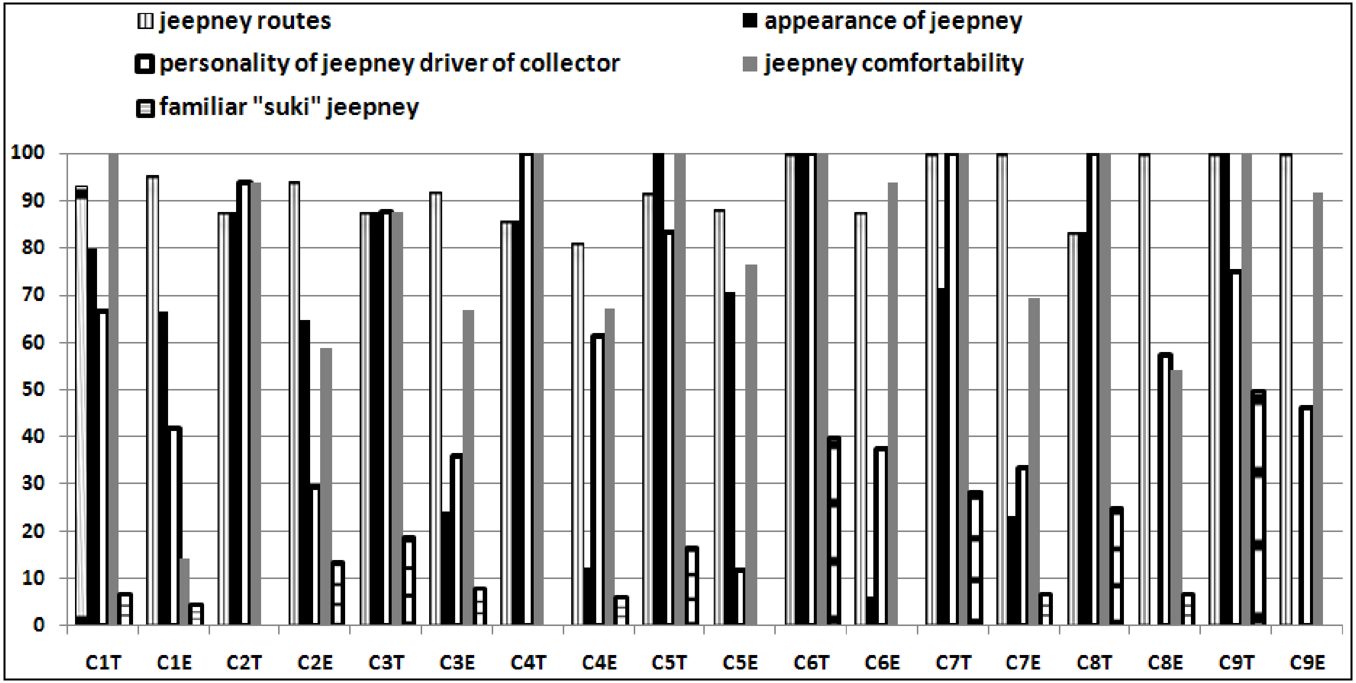

Figure 1. Preferences of Industrial Technology students (T) and Engineering students (E) from Clusters 1- 9 (C1 - C9) in response to uncertainty when attending a regular class for a Math subject.

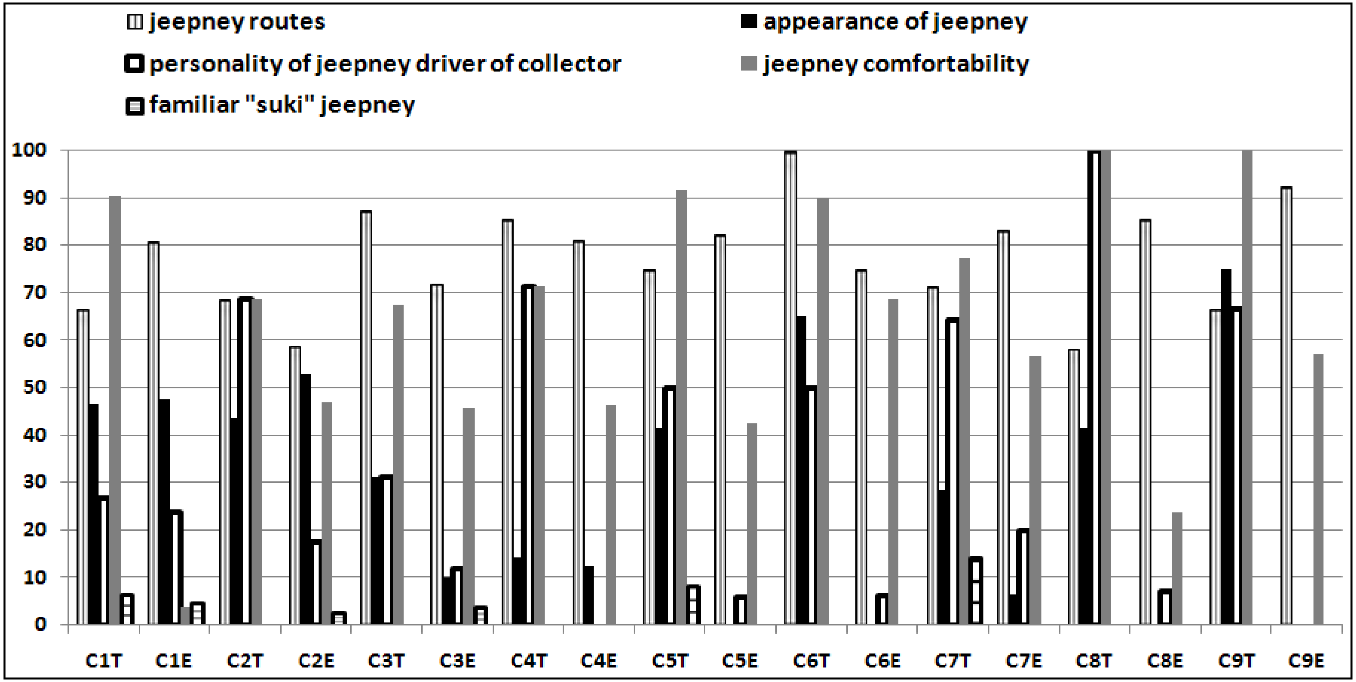

Figure 2. Preferences of Industrial Technology students (T) and Engineering students (E) from Clusters 1- 9 (C1 - C9) in response to uncertainty when there is a quiz for a Math subject.

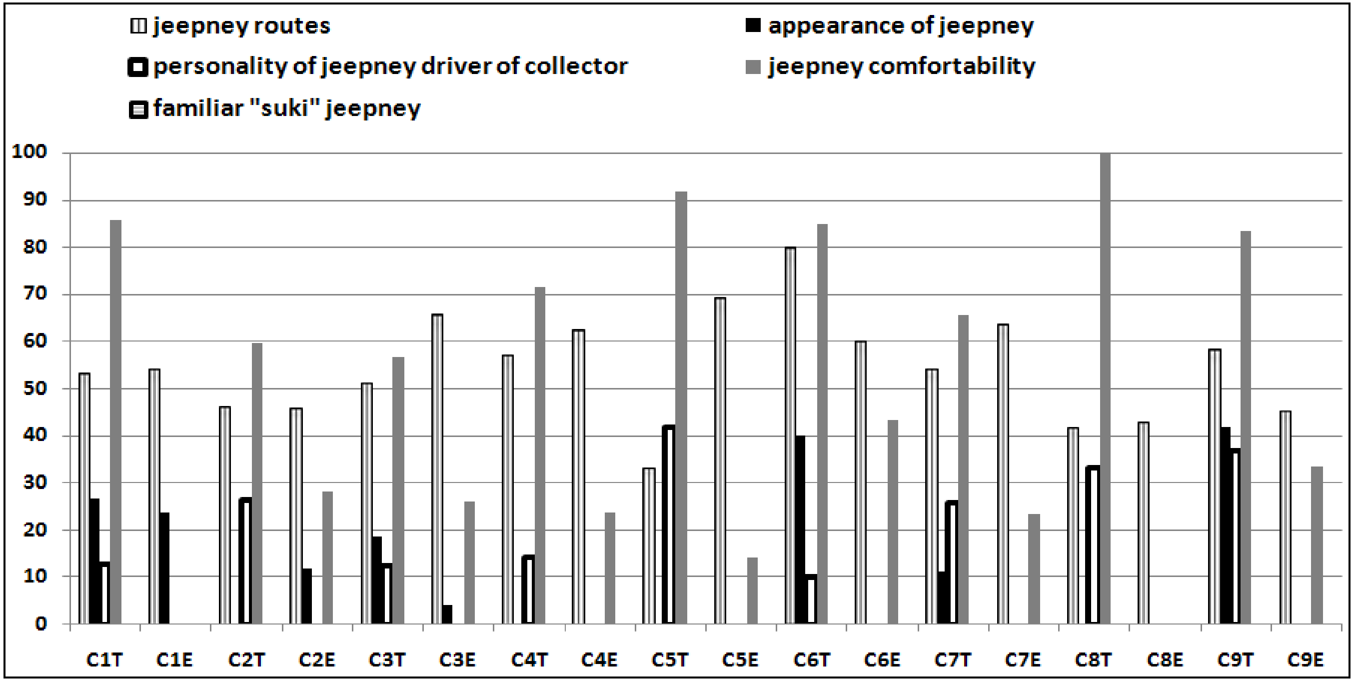

Figure 3. Preferences of Industrial Technology students (T) and Engineering students (E) from Clusters 1- 9 (C1 - C9) in response to uncertainty when there is an exam for a Math subject.

Figures 4 - 6 show the preferences of Industrial Technology students and Engineering students from the different clusters in response to uncertainty when attending a regular class, sitting in for a class quiz, or taking a major exam for a *non-Math* subject. It can be observed from these figures that although the preferences considered both by the industrial technology students and the engineering students when making their travel decisions tend to diminish according to their trip purpose, engineering students tend to include more preferences as compared to the industrial technology students in all three scholastic activities.

Moreover, jeepney comfortability is a common preference by both student groups. However, the number of industrial technology students who include jeepney comfortability in their travel preference decrease significantly, as compared to the number of engineering students, as the scholastic activity becomes more important (that is, a fewer number of industrial students consider this travel preference when there is an exam than when attending a regular class for non-math courses while still a significant number of engineering students consider this preference in all three scholastic activities).

It is interesting to note that industrial technology students tend to include more preferences for trips to math classes as compared to trips to non-math classes. This travel behavior implies that most of the industrial technology students tend to dislike experiencing travel uncertainties for trips to non-math as compared to trips for math subject. On the other hand, a different behavior is observed among engineering students. They tend to consider more preferences for trips to non-math classes than for math classes, which could mean that most engineering students aim to reduce their travel uncertainties when attending math classes, thereby resulting to lesser total travel time.

Based on the data obtained in this study, a ***travel time budget*** T_c model for each cluster c can be formulated as follows:

For each $c = 1, \dots, 9$;

$$T_c = t_r + \sum_{i=1}^{5} p_{ic}\, a_{ic} + \sum_{i=1}^{4} q_{ic} b_{ic} \qquad (4)$$

where t_r is the actual travel time associated with each route r; p_{ic} and q_{ic} are, respectively, the controllable and uncontrollable factors chosen (p_{ic} = 1 if a_{ic} is chosen, 0 otherwise; similarly, q_{ic} = 1 if a_{ic} is chosen, 0 otherwise); and a_{ic} and b_{ic} are the penalty associated with each cluster c for the controllable and

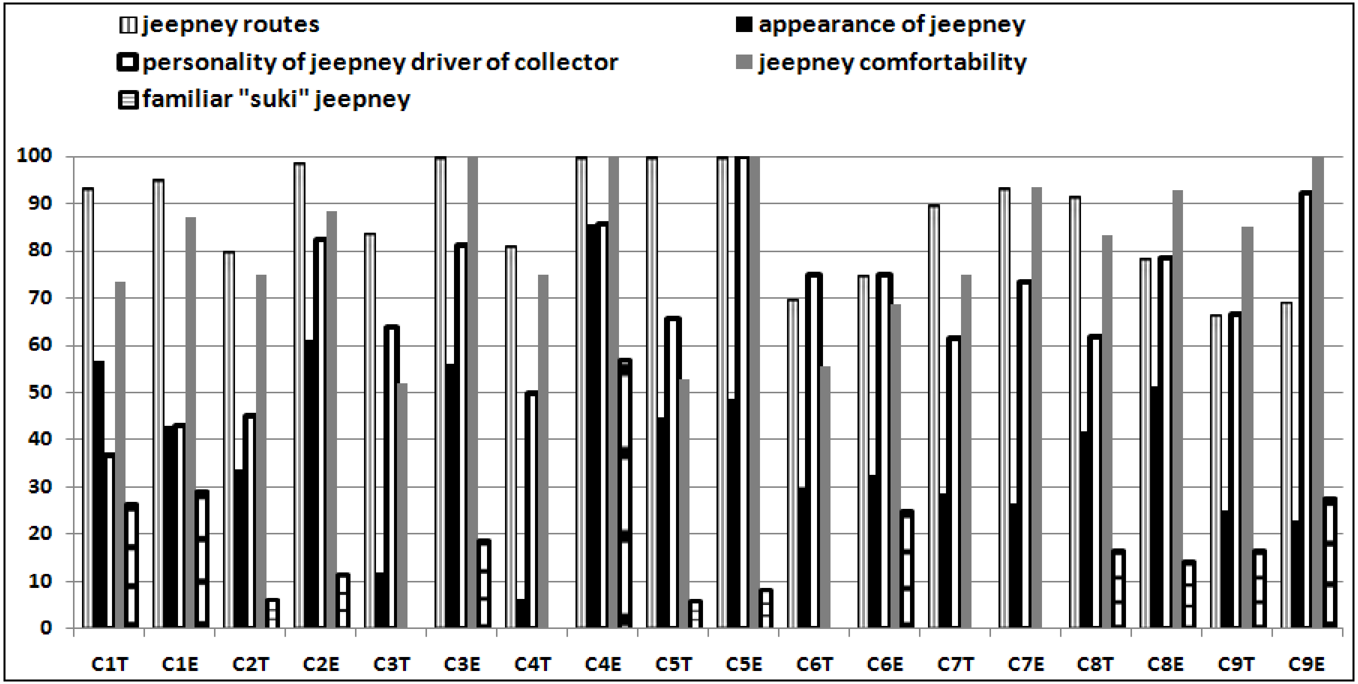

Figure 4. Preferences of Industrial Technology students (T) and Engineering students (E) from Clusters 1- 9 (C1 - C9) in response to uncertainty when attending a regular class for a non-Math subject.

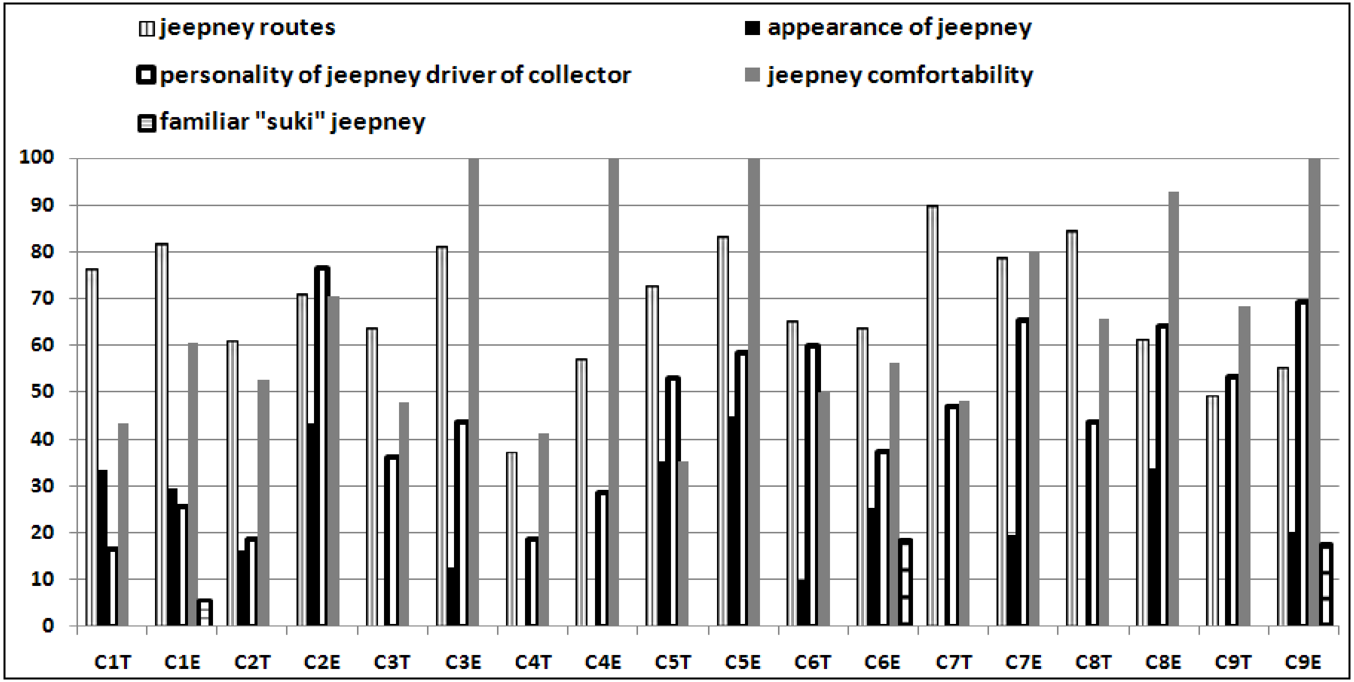

Figure 5. Preferences of Industrial Technology students (T) and Engineering students (E) from Clusters 1- 9 (C1 - C9) in response to uncertainty when there is a quiz for a non-Math subject.

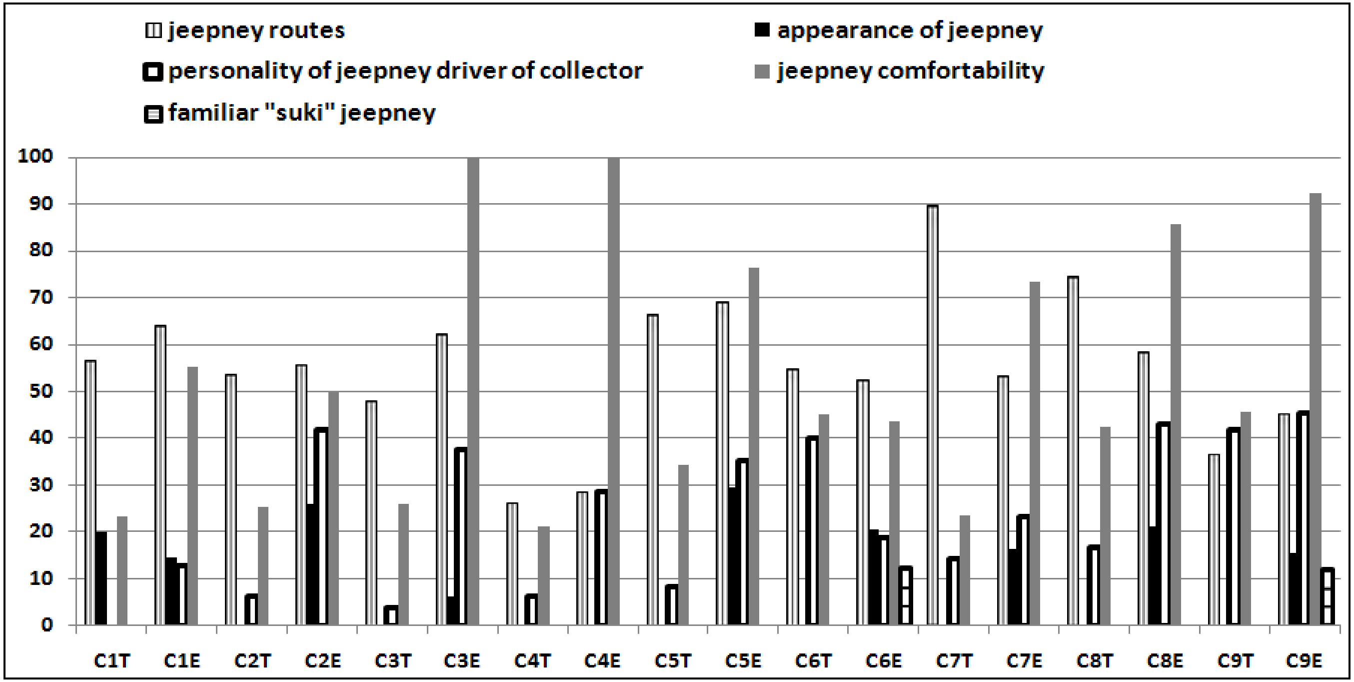

Figure 6. Preferences of Industrial Technology students (T) and Engineering students (E) from Clusters 1- 9 (C1 - C9) in response to uncertainty when there is an exam for a non-Math subject.

uncontrollable factors (as shown in Tables 4-5). As compared to the travel time budget model of Lo, *et al.* (2006), (2) presents a more simplified travel time budget which can be used by students since the factors affecting travel uncertainties are considered and the corresponding penalties for each preferences are included in the model. This model will assist every student from a particular cluster in deciding which preferences to choose given his/her trip purpose and the desired departure from home or arrival time to MUST.

5. Conclusion

In this study, the various preferences considered by the Industrial Technology and Engineering students in their travel decisions have been investigated. Moreover, the effects of these preferences to their travel behavior in relation to their trip purpose have been considered.

It has been observed that the number of preferences they considered decrease depending on their trip purpose, that is, students tend to consider fewer preferences for more important scholastic activities. Moreover, it can be observed from the results that punctual arrival to non-mathematics courses is regarded to be more important than for mathematics courses as can be seen in the (lesser) number of preferences they include in their travel plan. Hence, in the preparation of class schedules for industrial technology and engineering students, it may be helpful to arrange the schedules for their math and non-math courses, taking into consideration the travel behaviors of these students. It may be a good idea to schedule morning classes for Math courses of industrial technology students after a non-Math course. On the other hand, morning classes for non-Math courses of engineering students may be scheduled after a Math course.

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