A Study on Travel Choices of College Aged Students

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Abstract— College going students generally neglected for transportation studies whose campus lies in the rural areas. But the fact is, college going students contribute highly towards overall traffic generation in the area. The study will be effective to know the travel behaviour and will be beneficial for development and planning initiatory which will contribute into achievement of sustainable and safer transport system. A case study involving more than 800 college students of Panipat institute of engineering and technology was carried out. Students were encouraged to take part in the survey and to give their views about mode choice and factors responsible for choosing mode. Safety concerns are more likely to affect travel choices as well as other factors such as gender, age, distance. We try to identify other factors also such as family status and department in which students are studying in the college. In our study, numerous students were motivated to take part in the survey and we observe that 60% travel through college bus, 19 % through cars, 10 % walk to the college, 8% travel through motor bikes and rest through other modes travel to colleges. Choices for trips different from colleges were also studied such as trips to picnic, trips to the market or other recreational areas. Apart from this multinomial logit model (MNL model) model is also prepared taking various parameters which affects the overall mode choice of college students.

Key words: Safety; Gender; Age; College; Travel; Students

I. INTRODUCTION

A study was carried out to check the travel patterns of the college students. The Trips of Students to the College are different from other trips. It is therefore likely that the factors affecting these trips will also be different. The trips of College students to College differ from most other trips. College students less likely to choose sustainable travel choices such as a bicycle, walking and prefer personal vehicles such as cars or motor bikes. Most of the students travel through college bus, because of the fact that college a campus that lies in the remote rural areas. Factors affecting travel choices for college students are studied here such as gender of the student, age of the student, department of the student, family status, and distance from the house to the college. Here we observe that female student, more likely travel through college buses due to safety concerns when travellling to college. The distance between college and their home are equally important for male and female both. But travel modes for other trips different from college trips give different picture altogether. As the distance decreases, motor bikes and walking become important mode but in very fewer numbers as compared to college bus. The data obtained from these surveys was then analysed, and Multinomial Logit (MNL) Model was prepared.

II. OBJECTIVE OF THE STUDY

To find the mode of choice of College students. Identifying the factors affecting decision-making regarding travel behavior. To find out the relationship between the factors influencing travel pattern of College Students with the mode of transportation. To help policy makers to find better alternatives to travel to college that is environment-friendly and economical for the students as well as for the colleges.

III. STUDY AREA

The study was carried out at Panipat Institute of Engineering and Technology located in Samalkha town of Panipat district of Haryana state. It is situated on NH-44 and at a distance of 70 miles from New Delhi with 19 acres of Campus. Institute carries almost 3500 students from various disciplines such as Engineering, Business administration, Computer science. Institute carries students of different age groups from 17 years to 22 years. Segregation of students department wise is shown in Figure 1.

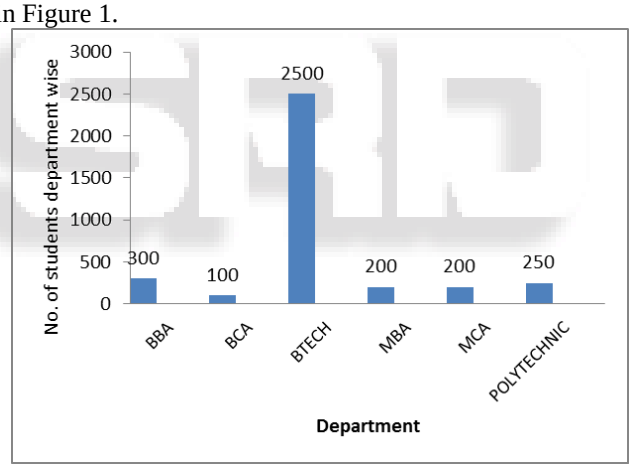

Fig. 1: No. of students Department wise

A. *Sample Size of Survey:*

This study is limited to panipat Institute of engineering and technology with total strength of more than 3500 students out of which more than 800 were surveyed. Considering the population size of students - aged between 17 and 22 years studying in college, the sample size for the questionnaire survey was determined according to the research nature and its limitations. While more than 1500 questionnaires were distributed among the students, out of which around 800 questionnaires were returned (the response rate was 54 percent).

IV. METHODOLOGY

The survey was conducted in the institute which covers age group of 16-22 years of different departments with almost 800 students as a sample.

1) A survey form was prepared as shown in Appendix I to conduct a survey of the students which comprise of the questions related to Age, Residence, family status, Department, gender and asked what mode they choose to travel to college, market places and picnic areas.
2) Through this survey different factors were studied which directly or indirectly affect the travel choices of the college students and relationships were established between various factors responsible which affect travel behavior of the college students.

V. RESULTS AND FINDINGS

A. Modal split of college students traveling to college (refer Figure 2):

Modal split shows that 60% of the students travel that 60% travel through College Bus, 19 % through cars, 10 % walk to the college, 8% travel through motor bikes and rest through other modes.

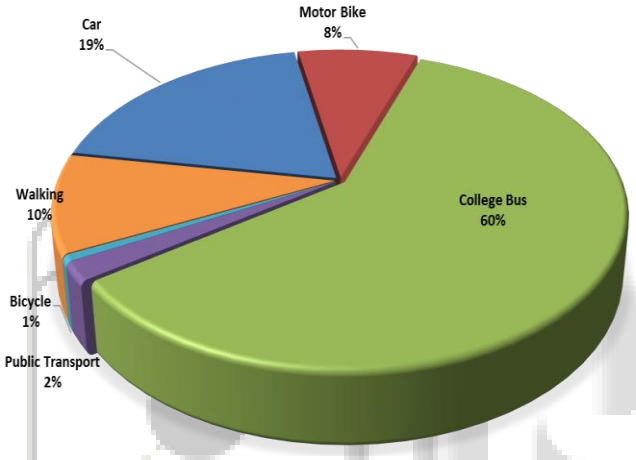

Fig. 2: Modal split of college students

B. Modal split of students traveling to market places (refer Figure 3):

It shows a different picture as compared to trips to college. We observe that 14 % walk, 44% travel through motor bikes, 22% through a car, 17% use public transport as a travel choice.

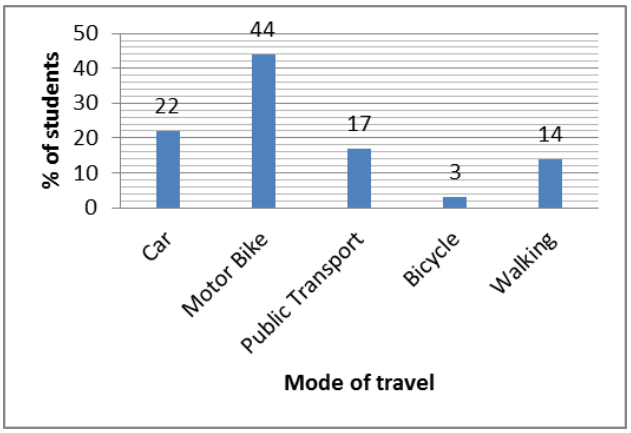

Fig. 3: Modal split of college Students travel to market places

C. Modal split of students travel to picnic and recreational areas (refer Figure 4):

It shows that 85% travel through cars, 4% through motor bikes, and 10% through public transportation.

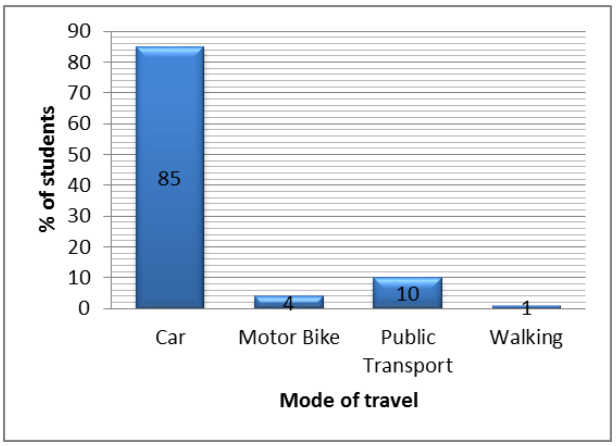

Fig. 4: Modal split of college student travel to picnic

D. Mode choice on the basis of family status (refer Figure 5):

It shows that high-income family students show the equal response for college bus and cars. As the income decreases of the family use of cars or persona vehicle decreases.

E. Mode Choice on the basis of residential area (refer Figure 6):

It shows that students coming from urban and suburban areas generally prefer college bus and

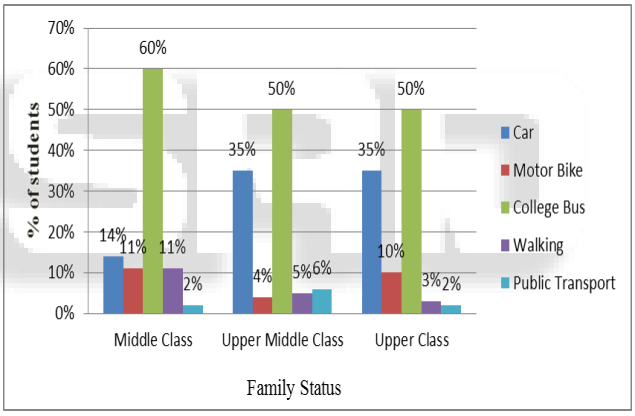

Fig. 5: Mode Choice according to family status.

F. Mode Choice on the basis of residential area (refer Figure 6):

It shows that students coming from urban and suburban areas generally prefer college bus and personal vehicle as compare to students coming from villages. This is because of the location of the college in remote areas.

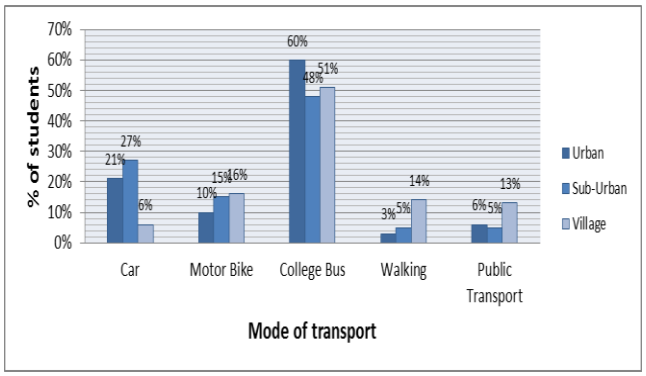

Fig. 6: Mode choice on the basis residential area of students

G. Mode choice on the basis of age (refer Figure 7):

Almost 80% of the female students travel through college bus traveling to college and less likely to travel through other modes. On the other hand, male students prefer personal vehicle and college bus.

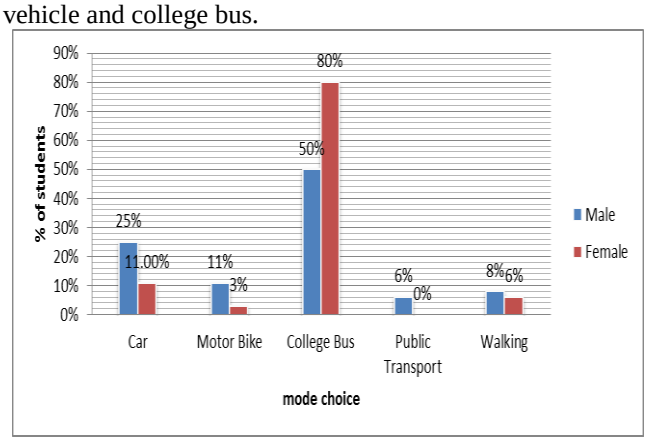

Fig. 7: Mode choice on the basis of gender of the student

H. Mode choice on the basis of age of the student (refer Figure 8):

It shows mixed response and bus are considered as major travel choice of all age groups in the Institute. As the age increases personal vehicle is more likely to be chosen.

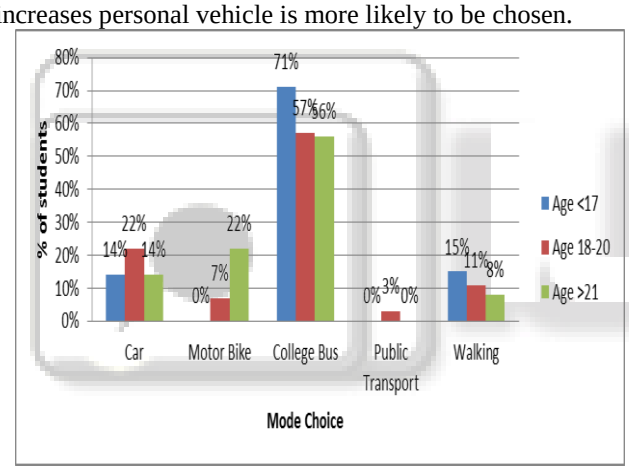

Fig. 8: Mode choice on the basis of age

I. Mode choice on the basis of the department in which students are studying (refer Figure 9):

It shows that students of all courses almost prefer college Bus but BBA students which are economically strong and from business families are more likely to travel by personal vehicles i.e. car as compare to other courses.

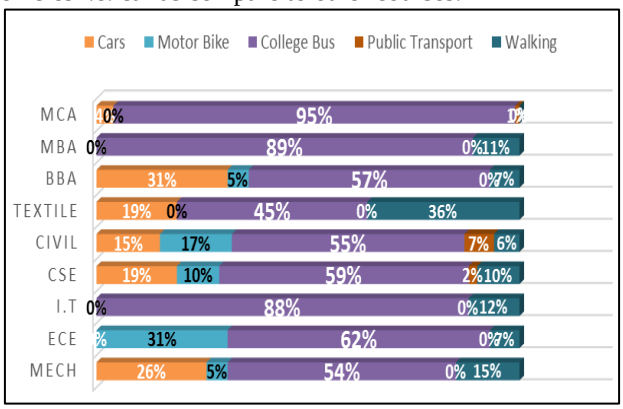

Fig. 9: Mode choice on the basis of department of the Institute

VI. MULTINOMIAL LOGIT MODELLING

The purpose of generating a Multinomial Logit (MNL) model was to provide a method to estimate the mode choices of college studenst. To get the desired variables, The MNL model is prepared from the small sample collected through survey, to get the desired variables. This model could be used to explore the probability of choosing different modes other than "College Bus" and could be helpful in future planning procedure. Apart from this, the MNL model can help in estimating the factors influencing number of independent variables in choosing mode of travel.

A. The multinomial logit model (XLSTAT version 2017):

In multinomial logit model there are more than two dependent variables. Its main focus is on finding out the probability of choosing one, out of the no. of categories say "j" which is dependent on some explanatory parameters. The expression used for the model is: Log [p(y =j | xi) / p(y =1 | xi)] = αj +βjXi where the category 1 comes under the reference or control category. All other parameters are explained relative to this control category or parameter. The probability in choosing category "j" is as follows i.e. p(y = j | xi) = exp(αj + βjXi) / [1 + Σk=2.J exp(αk + βkXi)]. For the control category, we have: p(y =1 | xi) = 1 / [1 + Σk=2.J exp(αk + βkXi)]. The model is generated or estimated using a max. Likelihood ratio method; the log-likelihood is expressed as: l(α,β) = Σi=1.nΣj=1.Jyij log(p(y=j|xi))To estimate the β parameters of the model (linear function coefficient), here we are trying to maximize the likelihood function. An exact analytical solution does not exist as in linear regression. To find the best possible solution the software XLSTAT 2017 uses the Newton-Raphson algorithm. (Source: XLSTAT 2017 tutorials).

B. Mode Choice Estimates

Mode choice model is generated through collge survey data. More than 60% of total trips were recorded as " collge Bus" trips . Other modes have much lower percentage individually and was not possible to generate model that is why we combined all modes other than "bus" and named as "other" and generated a modal taking these two alternatives[1]. The model was prepared taking different parameters such as Department, age, residence, gender, and family class. The data constituting a separate entity was analyzed using the XLSTAT 2017 MNL program. Almost 350 samples were collected for model formulation.

C. Details of Model

Number of observations: 349
Model: Logit
Response type: Multinomial
Control category: BUS
Constraints: a1=0
Confidence interval (%): 95
Stop conditions: Iterations = 100 / Convergence = 0.000001
Maximization of the likelihood function using the Newton-Raphson algorithm

Table 1, Table 2, Table 3 show the descriptive statistics of variable mode and validation data set respectively.

Variable	categories	Frequencies	%
MODE	BUS	223	63.897

	OTHER	126	36.103

Table 1: Summary Statistics

Variable	Observations	missing	Without missing	Min.	Max.	Mean	Std. deviation
AGE	349	0	349	16.0	21.0	18.344	1.249

Table 2: Descriptive Statistic on Quantitative Variable.

Variable	Categories	frequencies	%
DEPARTMENT	BBA	30	8.596
	BTECH	250	71.633
	MBA	21	6.017
	MCA	20	5.731
	POLYTECHNIC	28	8.023
RESIDENCE	SUB-URBAN	94	26.934
	URBAN	194	55.587
	VILLAGE	61	17.479
GENDER	FEMALE	159	45.559
	MALE	190	54.441
FAMILY CLASS	MIDDLE	243	69.628
	UPPER MIDDLE	106	30.372

Table 3: Descriptive Statistic on Qualitative Variables.

Table 4 shows the value of pseudo R-square which are quite satisfactory as per the requirement of the model.

Pseudo R-Square	Value
R^2(McFadden)	0.642
R^2(Cox and Snell)	0.568
R^2(Nagelkerke)	0.779

Table 4: Pseudo R-Square

Table 5 shows the null hypothesis which indicate that Pr >Chi^2 values are <0.0001 which is ok for the model.

Statistic	Degree of Freedom	Chi-square	Pr > Chi^2
-2 Log(Likelihood)	9	293.293	< 0.0001
Score	9	196.426	< 0.0001
Wald	9	71.829	< 0.0001

Table 5: Test of Null Hypothesis

Table 6 shows that value Pr>Lr for all the independent variables are less than 0.05 which is good for the model. Here source column describes the independent parameters taken into consideration for the model generation.

Source	DF	Chi-square (Wald)	Pr > Wald	Chi-square (LR)	Pr > LR
AGE	1	41.999	< 0.0001	81.824	< 0.0001
DEPARTMENT	4	49.742	< 0.0001	141.426	< 0.0001
RESIDENCE	2	40.313	< 0.0001	82.859	< 0.0001
GENDER	1	2.193	0.139	27.123	< 0.0001
FAMILY CLASS	1	24.147	<0.0001	128.967	< 0.0001

Table 6: Type III Analysis

Table 7 below showing "value" column gives the utility factors to generate the model and to find out the probability of choosing different modes.

Category	Source	value	Std. error	Wald Chi -Square	Pr > Chi^2	Wald L.B (95%)	Wald U.B (95%)	Odds ratio	L.B (95%)	U.B (95%)
Other	Intercept	30.54	4.72	41.873	<0.0001	21.288	39.787			
	Age	-1.59	0.25	41.999	<0.0001	-2.069	-1.108	0.204	0.126	0.330
	BBA	0.00	0.00							
	BTECH	1.024	0.50	4.187	0.041	0.043	2.005	2.784	1.044	7.425
	MBA	8.72	1.72	25.784	<0.0001	5.354	12.084	6117	211.351	177087
	MCA	8.10	1.68	23.266	<0.0001	4.809	11.392	3296	122.604	88610
	Polytech	-3.66	0.90	16.387	<0.0001	-5.430	-1.887	0.026	0.004	0.151
	Suburban	0.00	0.00							
	Urban	-3.47	0.56	38.545	<0.0001	-4.571	-2.377	0.031	0.010	0.093
	Village	-4.95	1.73	8.205	0.004	-8.335	-1.563	0.007	0.000	0.210
	Female	0.00	0.00							
	Male	0.56	0.38	2.193	0.139	-0.182	1.307	1.755	0.834	3.693
	Middle class	0.00	0.00							
	U. Middle cl.	-7.74	1.58	24.147	<0.0001	-10.828	-4.653	0.000	0.000	0.010

Table 7: Model Parameters

Table 8 shows the classification tables for estimation sample showing satisfactory % correct for the model.

From/to	Bus	Other	Total	% Correct
Bus	198	25	223	88.79%
Other	18	108	126	85.71%
Total	216	133	349	87.68%

Table 8: Classification Table for the Estimation Sample (Variable Mode):

D. Model results

Analysis of the model to be significant and valid as per the guidelines of the software shown below:

1) From Table 4 we can observe that R^2 (Cox and Snell), R^2 (McFadden) and R^2 (Nagelkerke) are 0.568,0.642, 0.779 because as the value close to 1 the model is well adjusted.
2) Table 6 shows that the Pr > LR value is much lesser than a significance threshold value which is (typically set to 0.05 because in this case confidence interval is 95%), which conclude that the contribution of the independent variables to the model adjustment is significant as compare to other parameters.
3) From Table 7, if the "value" is negative then it shows that the variable is less likely to go for corresponding mode as compare to "bus" because here bus is base variable and value 0 shows the parameter to be redundant and work as reference parameter in particular variable.
4) Table 8 shows % correct is 87.68% which is very good or excellent result[2]
5) Finally equation of model is given below as follows:

Probability (other)=

$$\left[\frac{1}{1+e^{(-30.54+1.59*A-1.02*B-8.72*C+3.66*D+3.48*E+4.95*F-0.56*G+7.7*H)}}\right]$$

Where:

A= Age of students
B= no. of BBA students
C= no. of MBA students
D= no. of polytechnic students
E = no. of urban residents
F= no. of village residents
G = no. of male students
H= no. of students from upper middle class family

Above equation can be used to calculate the probability of choosing mode other than "Bus" on putting values of different parameters and multiplying their coefficients from Table 7 i.e. from "value" column.

VII. Conclusion

Almost 800 students from various background surveyed and mode choices of students have been identified with help of survey form. In the study, we find safety is the major concern for female students as compared to male students. Students with a good family background in terms of economy prefer personal vehicles more frequently in traveling. College bus is the most preferred mode due to the fact that college campus located in the rural areas away from the city. Mixed response was observed in terms of age of the students. Students residing in the urban and sub-urban areas prefer personal vehicle more frequently as compare to students of rural areas. Through this study we also get information regarding other trips by the college going students such as trips to the market or recreational places, we observe that they choose personal vehicles such as cars and motor bikes more frequently as compare to other modes. In this study we observe that students like to drive themselves to the college but not possible due to family pressure and long distance between college and their homes due to this they have to choose college bus in most of the cases, that is why we identify other trip choices of the students such as trips to market places and recreational purposes so as to get actual travel behaviour of the college students. We can conclude that in future, the "model equation" model generated above in this Article would be very helpful in future planning which provide the probability of choosing mode other than bus by school pupils. Parameters such as Department, age, residence, gender, and family class are considered to be the contributing factors in estimating the overall pattern of the college students. This type of study will help policy makers to improve transportation infrastructure in the area as well as in the institutes. This study can be further extended to surveys of other institutes. This will help in identifying the impact of geographical locations and how economically weak and less developed infrastructure than urban areas are different in college travel decision making. This survey can be extended to different areas of the country and to explore whether these factors are applicable to other areas also.

Acknowledgement

I would like to thank my Engineering students of final year for helping me in collecting survey data for the study.

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