

Analysis on Students' Travel Activity Pattern in Technological University (Kyaukse), Myanmar

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Abstract: Student's travel behaviors and activity patterns in the university area are expected to be different from the overall situations in the city area. The primary objective of this study is to analyze the trip rates (trips/day) depending on the student's characteristics by using the regression model. The results showed that the choice of activity pattern was significantly impacted by year level and types of accommodation. The other variables, which were age, gender, income or allowance, students have the driver license or not and they have their own vehicle or not, were found to be not significantly related to the choice of activities. And then, the average trip rate of students at Technological University (Kyaukse) is 8.0trips/day. Motorcycle is the most dominant mode of transportation used by the students. Findings of this study provide important suggestions for the policy makings to improve the traffic situations.

Keywords: Activity Pattern, Regression, Trip Rates, University Students

1. INTRODUCTION

Understanding mechanism of individual travel pattern in urban space is important for urban transportation planning and congestion management. It provides useful information for effectively handling travel demand. There are two basic approaches for transportation planning: trip-based approach and activity-based approach. The former approach uses individual trips as the unit of analysis and usually includes four sequential steps which are trip generation, trip distribution, mode choice and assignment (Bhat, et al., 1999). The later approach which is activity based modelling of travel demand treats travel as being derived from the demand for activity participation. It has been argued that the activity-based modelling approach can offer a rich framework in which travel is analyzed as a daily pattern of behavior related to and derived from differences in lifestyles and activity participation among individuals (Yagi, et al., 2010). Reliable estimates of travel patterns cannot be obtained from the conventional trip based four steps method, therefore, the activity-based models have been developed. Activity-based modelling are more popular in developed countries than in the developing countries, whereas the transportation related problems such as congestion and air quality issues are more severe in developing nations (Yagi and Mohammadian, 2010). India, the third world nation, is well known for its social, cultural and geographic diversity. This diversity in socio-economic and demographic features results in different lifestyles and hence varying travel characteristics. In order to understand such travel characteristics, activity-based approach is essential in Indian context. Students at urban university campuses often have more complicated travel patterns than other commuters. Very few studies have documented university students' travel behaviour explicitly, and thus their travel choices and preferences are not well known. Understanding travel patterns and

transportation user choices is important for serving student transportation needs within and around university campuses and promoting active and shared transportation mode choices. For instance, University education and experience has a crucial role in personal growth, social progress and sustainable development . Educational trips, which means school and university trips, are one of the main components of urban trips. In university, students may have different travel behaviors and daily activities of their own. Furthermore, the regular and irregular class schedules, which have been changing with the individual courses, allow them to have various activities in the entire day. These factors make the daily schedules and travel patterns of university students complicated. So, students have the high travel rates, the complex travel patterns and the most usages of the city’s road. On the other hand, the travel demand of the students becomes more day by day. Therefore, this study proposed to the activity-travel patterns of students at Technological University (Kyaukse).

2. STUDY AREA

Technological University (Kyaukse) was considered in this study to conduct the relevant analysis on the activity travel patterns of students. The university is located in Myopet Street, Yesu Quarter in Kyaukse, Myanmar. It has approximately 2087 enrolled students. It is popular and known as one of the universities having based learning in particular field of engineering in the country.

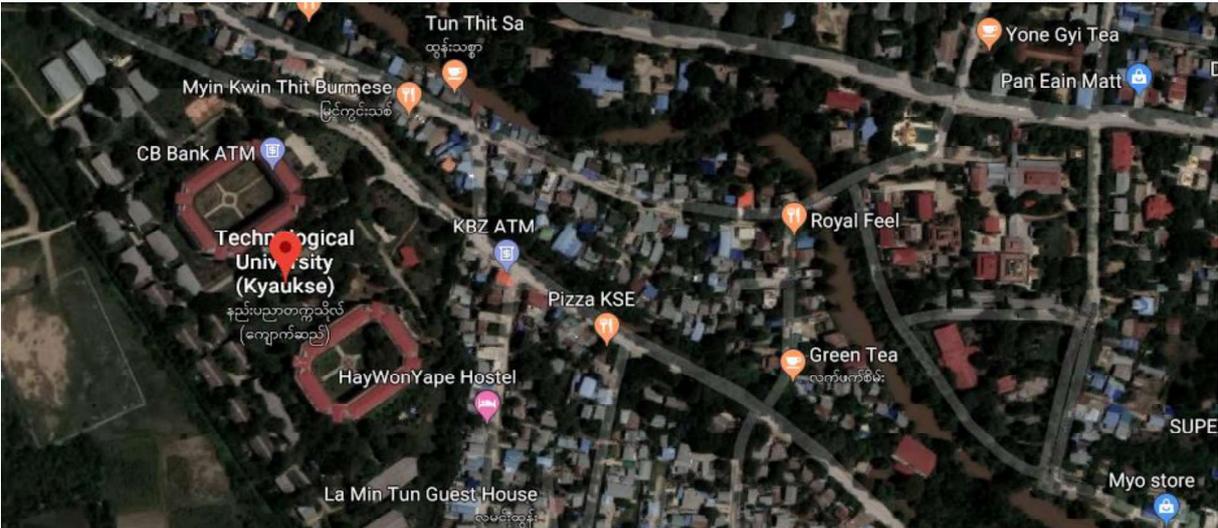


Figure 1. Location of the Study Area

3. DATA RESOURCE

Data used for analysis were obtained from the students of Technological University (Kyaukse), Myanmar in year 2019. The surveyed individuals were randomly collected through face to face interview with the aid of questionnaires that included a complete a travel diary for one school day. The survey asked participants included two parts: (1) demographic characteristics (age, gender, income, etc.), (2) one day activity-travel data (travelling to school, attending class, taking meals, etc.). A total of 500 samples were collected but 482 samples (96.4% valid responses) were obtained for analysis after cleaning the data and removing those with incomplete information.

3.1 Data Collection and Cleaning

A total of 500 samples are distributed to students. As shown in Figure 2, 490 samples are collected and 10 samples are not returned. And then, as shown in Figure 3, 482 samples are used for analysis after these data is cleaned and removed with incomplete information.

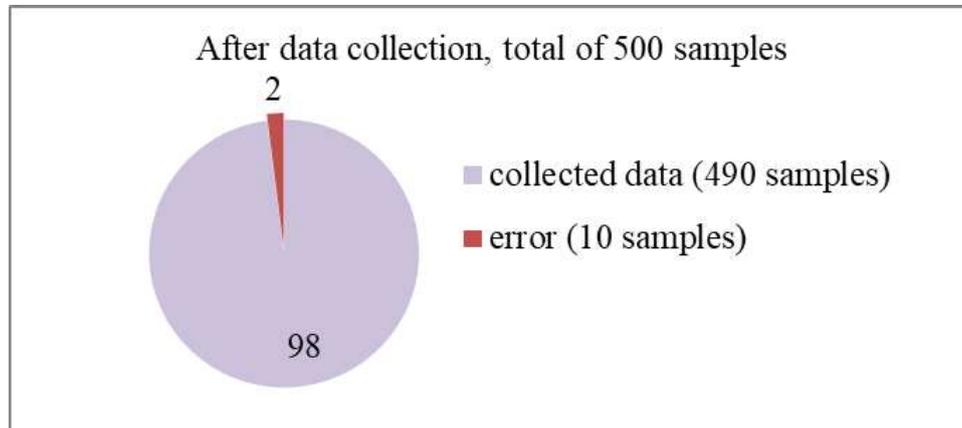


Figure 2. Data Samples after Collection

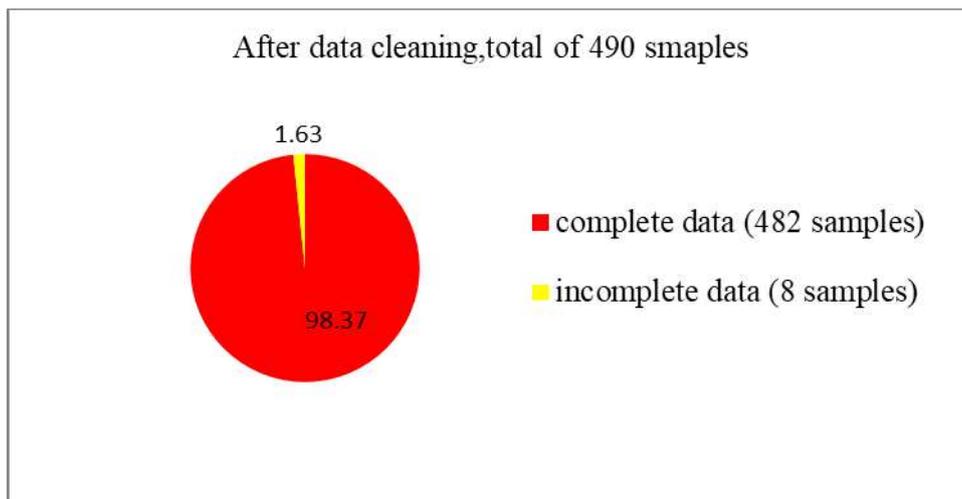


Figure 3. Data Samples after Cleaning

4. METHOD OF DATA ANALYSIS

Multiple regression is an extension of simple linear regression. If two or more independent variables, rather than just one analyze in the model, multiple regression is used. Multiple regression model is used to predict the value of a dependent variable based on the value of two or more independent variables. This model also determines the overall fit of the model and the relative contribution of each of independent variables to the total variance explained. The independent variables may be continuous or categorical variables. Every value of the independent variable x is associated with a value of the dependent variable y . The population regression line for p explanatory variables x_1, x_2, \dots, x_p is defined as:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_p x_{ip} + E \quad (1)$$

where,

β_0 = y intercept (constant term)

β_p = slope coefficients for each explanatory variable

y_i = the dependent variable

x_i = the independent variables

E = the model's error term (also known as the residuals)

5. RESULTS AND DISCUSSION

This section provides the descriptive analysis, average daily student trip rates by status, mode used for the trip, frequencies of activities and time allocation of activities by students. The student' information includes age, gender, year level, income or allowance, accommodation type, students have the driver license or not and they have their own vehicle or not. The descriptive statistics of the sample are shown in Table 1.

Table1. Statistics of Explanatory Variables for Model Development

No	Variable	Coding and Definition	Number of Students (N=482)	Percentage (%)
1	Gender	0 : Male	233	48.34
		1 : Female	249	51.66
2	Age	1 : <18	120	24.90
		2 : 18-22	253	52.49
		3 : >22	109	22.7
3	Monthly Allowance	1 : <\$100	218	45.23
		2 : \$100-150	211	43.78
		3: >\$150	53	11.00
4	Year Level	1 : First	86	17.84
		2 : Second	122	25.31
		3 : Third	58	12.03
		4 : Fourth	64	13.28
		5 : Fifth	83	17.22
		6 : Sixth	69	14.32
5	Type of Accommodation	1 : Dormitory	37	7.68
		2 : Hostel	196	40.66
		3 : Home	249	51.66
6	Travel Modes	Walking	124	25.73
		Bicycle	2	0.41
		Motorcycle	183	37.97

		Ferry	167	34.65
		Private car	6	1.24
7	Driver's License Ownership	1 : Yes	308	63.90
		0 : No	174	36.10
8	Vehicle ownership	1 : Yes	275	57.05
		0 : No	207	42.95

Table 2. Numbers of Trips and Corresponding Number of Students

Number of trips per day	Number of Students (f)	Class midpoint (X_m)	f. X_m
1-5	50	3	150
6-10	342	8	2736
11-15	81	13	1053
16-20	9	18	162
Total	482		4101
Mean			8.5

The maximum number of 342 students are observed to be taking trips during 6 to 10 number of trips. The average trip rate of students in Technological University (Kyaukse) is 8 trips/day.

5.1 Average Trip Rates of Students by Year Level

Firstly, average trip rates of students by year level and characteristics of students (such as gender, monthly allowance, type of accommodation, mode choice, driver's license ownership and vehicle ownership) by descriptive analysis.

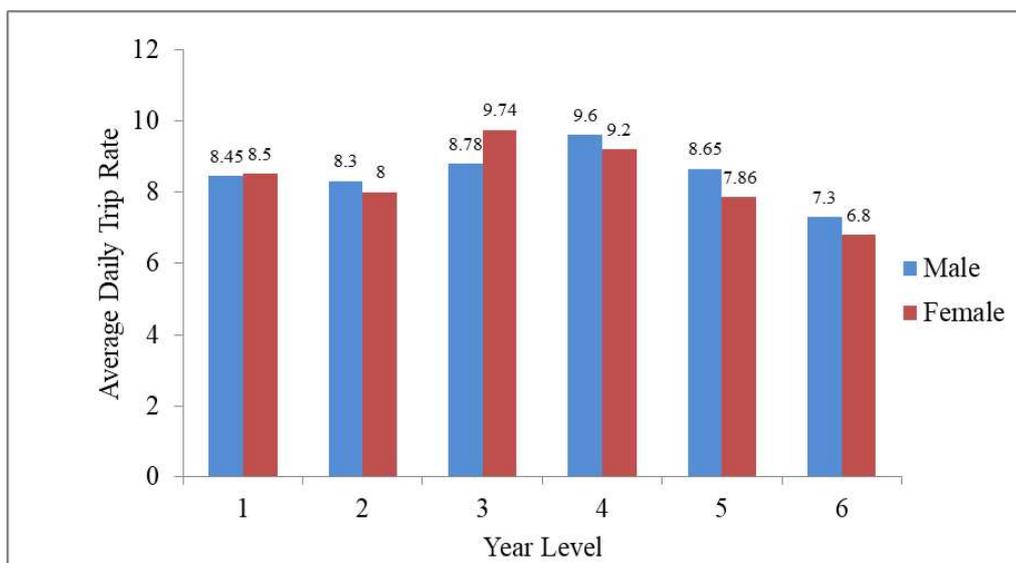


Figure 4. Average Daily Trip Rates of Students by Year Level and Gender

The X axis in the Figure 4 represents the first year, second year, third year, fourth year, fifth year and six year (labeled as 1,2,3,4,5,6) and the average daily trip rate are in Y axis. The figure also shows the average daily trip rate of male and female students according to the year level. It is shown that male students are more likely to take trips than female in almost all year level except third year students. The average daily trip rates of both male and female students in first year are nearly the same with 8.5 trips/day. The third year and fourth year students are seen to be the ones with most daily trips. This result indicates that the students in these years have more course schedules and campus activities than the rest of the students. The final year students are found out to have lowest trip rates (approximately 7trips/day). It means that they have fewer courses and most activities are for self-study of graduation thesis.

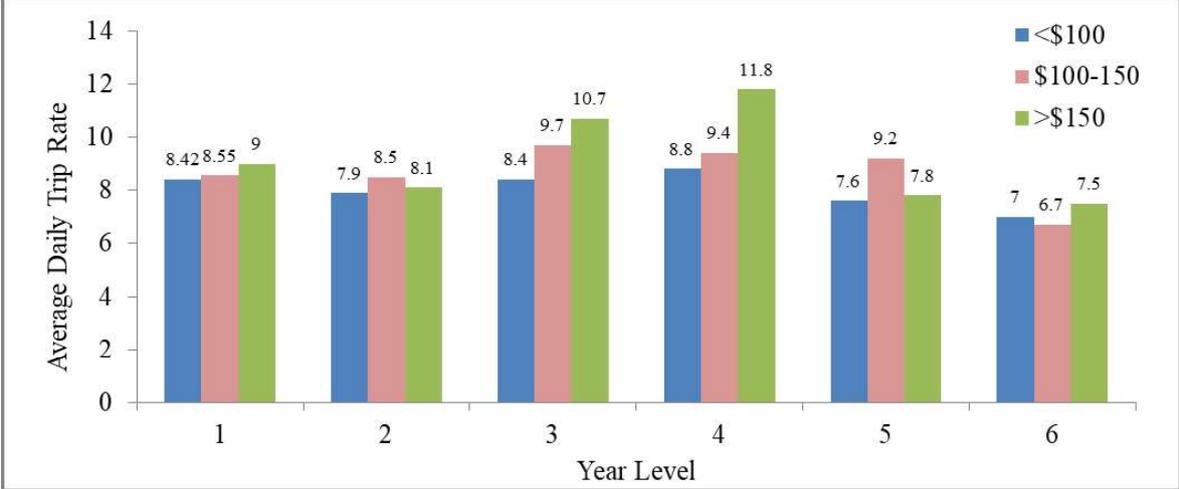


Figure 5. Average Daily Trip Rates of Students by Year Level and Monthly Allowance

Figure 5 presents the trip rate of students according to their allowance. It is found that the students with the allowance of above \$150 thousands are more likely to have average trip rates than the rest of the students in fifth year. It indicates that the more allowances the students have, the more trip they take.

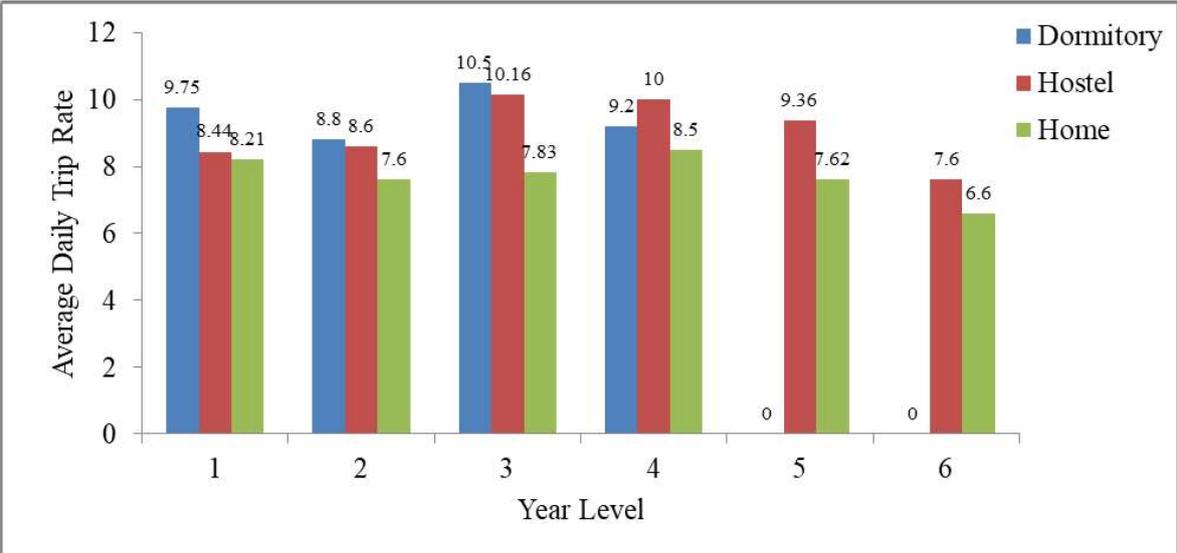


Figure 6. Average Daily Trip Rates of Students by Year Level and Type of Accommodation

Figure 6 shows the average daily trip rate of students according to the types of accommodation. According to the figure, only first year to fourth year students live in

dormitory and they have the most trip rates except fourth year students. The students who live in hostel have significant trip rates in fourth, fifth and six year. It can be seen that the students from dormitory and hostel have more trip rate than those from home. The decrease in trip rate of students from home may be due to the fact that they have more restriction than those from dormitory and hostel.

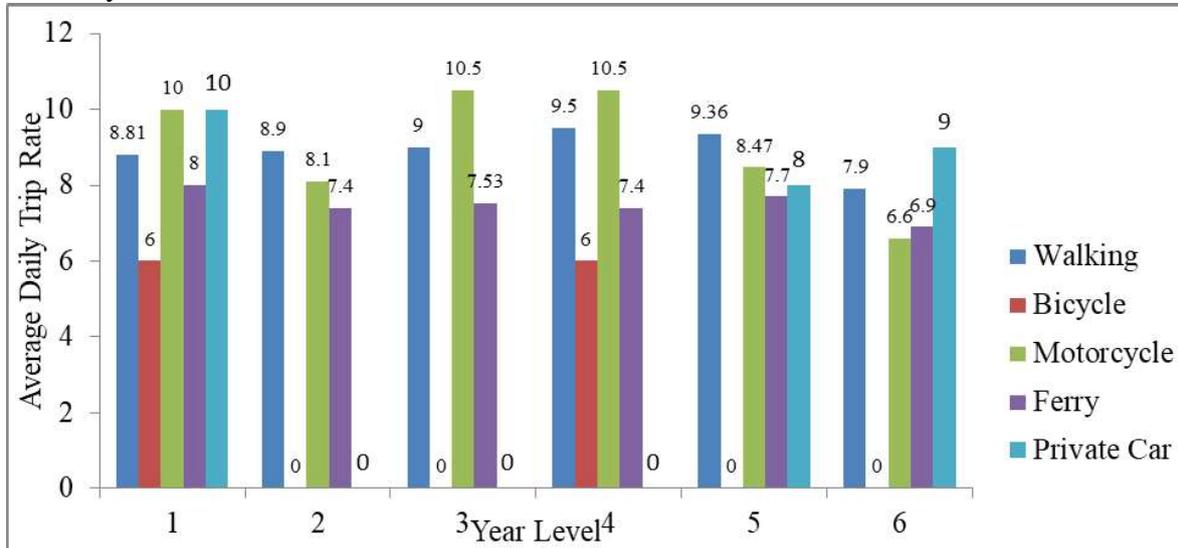


Figure 7. Average Daily Trip Rates of Students by Year Level and Mode Choice

Figure 7 shows the average daily rates of students by year level and mode choice. There are two types of mode choice. From this figure, it is evident that ferry, motorcycle and walking are the predominate modes. It can be observed that first year students use all modes. Bicycle usage can be found only in first year and fourth year and average daily trip rate by bicycle is about 6 trips. Walking, ferry and motorcycle are the popular modes for all year levels. Average trip rates by these modes are around 7 trips or more per day. In first year, third year and fourth year, the trip rates by motorcycle are the most and their trip rates are 10 trips and more. In second year and fifth year, average trip rates by walking are more than those by motorcycle and their trip rates are nearly 9 trips and over 9 trips respectively. It is indicated that students prefer to travel by walking in short distances which is also related to the cost and time. But, the trips made by private car are the most in final year and their trip rate is 9 trips per day. The results indicate that most of students make their daily activities by walking on campus and near campus. Moreover, the increase in trip rates by motorcycle and private car may be due to the fact that students can freely make their daily trips. And then, the decrease in trip rates by ferry may be due to the fact that students have similar daily activities.

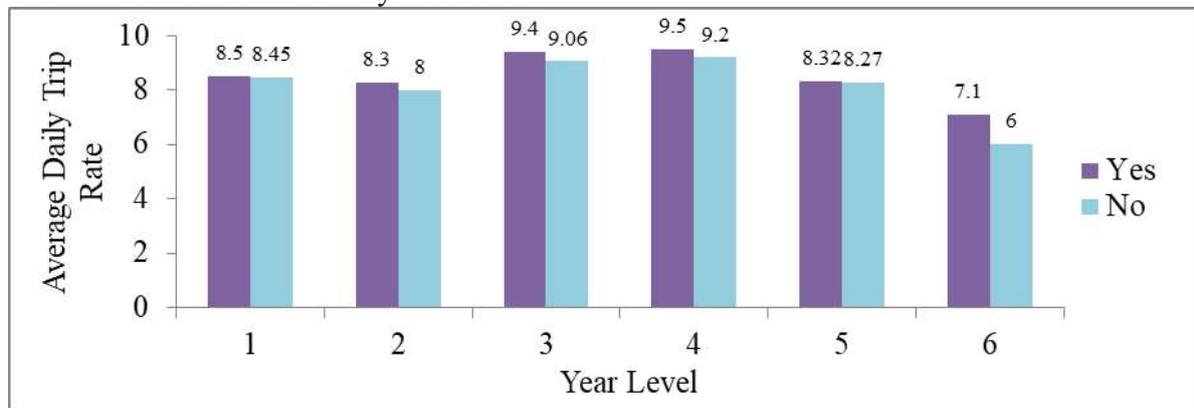


Figure 8. Average Daily Trip Rates of Students by Year Level and Driver's License Ownership

Figure 8 describes that the average daily trip rate of students according to the ownership of drivers' license. The students who have driver license are more likely to take trips than those who do not have driving license in all years. It indicates that most of the students have driver license. It is evident that driving without a license is illegal to drive any vehicle on any public street. Moreover, it may be stopped and investigate for a license by a police.

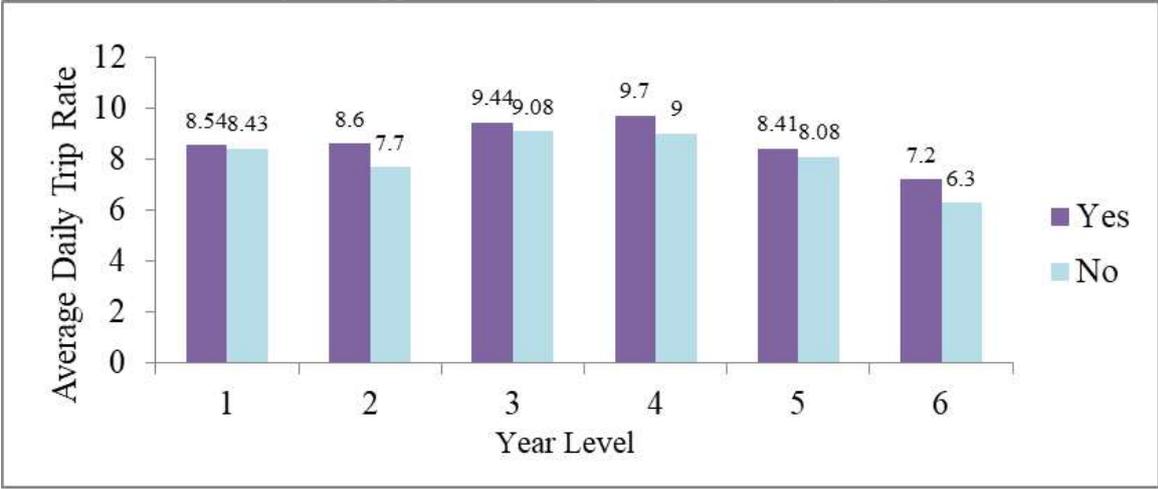


Figure 9. Average Daily Trip Rates of Students by Year Level and Vehicle Ownership

Figure 9 describes that the average daily trip rate of students in term of vehicle ownership. The average daily trip rates of students who own vehicle and do not have vehicle are nearly the same in first and fifth year. In comparing the daily trip rate of the students from second, fourth and sixth years according to vehicle ownership, the daily rate of students who own vehicle are more than those who own no vehicle. It may be because students who own vehicles are easier to do their activities on campus and outside. Moreover, most of students use vehicles even to go near campus or near accommodation because of convenience and saving time. It is evident that the higher the rate vehicle ownership, the greater propensity for travel and a demand for more roads.

5.2. Frequencies of Student Activities

A total of 4032 activities are recorded from the collected data. These are grouped into eight types of activities including traveling to school, attending class, rest/ break/ meal, recreation/ leisure (which include going to park, cinema and visiting), doing school work (which include research work or assignments, studying at the library, doing school project, etc.), social and organizational activity, shopping and going back to the accommodation. The frequency and total percentage of each of these groups of activities are presented in Table 3.

Table 3. Frequencies of Activities by Students and Average Number of Activities

Activity no.	Activity Description	Frequency	Percentage of Activities	Average Number of Activities
1	Travel to school	759	18.82	1.6
2	Attend class	830	20.59	1.7
3	Rest/ Break/ Meal	728	18.06	1.5

4	Recreation/ Leisure	236	5.85	0.5
5	Do school work	377	9.35	0.8
6	Social/ Organizational activity	173	4.29	0.4
7	Shopping	273	6.77	0.6
8	Travel back home/ dormitory/ hostel	656	16.27	1.4
Total		4032	100.00	8.4

From Table 3, activity of attending class has the highest percentage of activities, which is predictable to students as their main activity. Percentage of each activity is 18.82% for traveling to school, 20.59% for attending class, 18.06% for rest or break or taking meal, 5.85% for recreation or leisure, 9.35% for doing school work, 4.29% for social and organizational activity, 6.77% for shopping and 16.27% for going back to the accommodation. In there, students usually use more than one mode when doing these activities.

Table 3 also presents the average number of activities per students per day. The average number of attending class is the most frequent activity equivalent to 1.7. The average number of traveling to school, rest, break or taking meal and going back to the accommodation are respectively 1.6, 1.5 and 1.4. This means that students attend class and taking a rest or break or meal in a day more than once. In addition, students go to school and travel back home at least once in a day.

5.3. Time Allocation of Activities

Table 4 shows the average time allocation for activities and the average travel time when doing the activities. As presented in the table, the average activity duration for attending classes as well as the travel time to and from the school takes the biggest percentage of time allocated by students.

Table 4. Average Activity Duration and Travel Time

Activity no.	Activity Description	Total Travel Time (min)	Average Travel Time (min)	Total Duration (min)	Average Duration (min)
1	Travel to school	14673	30.44	-	-
2	Attend class	1652	3.43	115260	239.13
3	Rest/ Break/ Meal	3932	8.16	18411	38.20
4	Recreation/ Leisure	2928	6.07	12705	26.36
5	Do school work	1785	3.70	16921	35.11

6	Social/ Organizational activity	1216	2.52	7794	16.17
7	Shopping	2854	5.92	9198	19.08
8	Travel back home/ dormitory/ hostel	14028	29.10	-	-
Total Average		43068	11.17	180289	-

From Table 4, going to school and traveling back to the accommodation has the highest average time allocated. Students living outside the campus usually travel for at least 30 minutes. The overall average travel time for activities is around 11 minutes. This indicates that most of the students take the majority of trips within or near the campus. Activities such as class, study, meals, social-recreation, and shopping occurred mainly on or near the campus and they have similar average travel times.

5.4. Results for Statistical Model of Trip Rates

The trip rates depending on the student's characteristics are analyzed by multiple regression model. Furthermore, the independency of independent variables is applied to check the multi-collinearity test. The result of the correlation between two variables is described in Table 5 and model parameter estimation is shown in Table 6. According to Table 5, there is no strong relationship between two independent variables and no sign of multi-collinearity was detected.

Table 5. Correlation of model's independent variables

	Gender	Age	Monthly allowance	Year level	Type of accommodation	Having license or not	Vehicle ownership
Gender	1.000						
Age	-0.0312	1.000					
Monthly allowance	0.0762	0.309	1.000				
Year level	0.0171	0.5082	0.2967	1.000			
Type of accommodation	0.1133	-0.0146	0.3346	-0.0099	1.000		
Having license or not	-0.1346	0.2436	0.0653	0.3092	-0.0467	1.000	
Vehicle ownership	-0.1599	0.2297	0.2297	0.2337	-0.0666	0.478	1.000

Table 6. Results of the Model Parameter Estimation

Trip Rates	Coefficients	t	P > t
Gender	-0.256	-1.13	0.259
Age	0.084	0.32	0.748
Monthly Allowance	0.112	0.6	0.550
Year Level	-0.236	-2.12	0.034*

Type of Accommodation	1.438	6.07	0.000**
Driver's License Ownership	0.130	0.48	0.628
Vehicle Ownership	0.470	1.83	0.068
Constant	7.875	18.96	0.000

* is statistically significant at the 95% level.

** is statistically significant at the 99% level.

The first column shows the dependent variable at the top (trip rates) with the predictor variables (gender, age, monthly allowance, year level, type of accommodation, driver's license ownership, vehicle ownership and constant). The last variable (constant) represents the constant or intercept. And then, the coefficients are the values for the regression equation for predicting the dependent variable. As presented in Table 6, the sign of the coefficient of gender is negative which means that male students are more likely to make a trip compared to female ones. The result might be the fact that male students have more complex daily activities than female ones. In addition, the age has a positive sign which means that senior students are more likely to travel than junior ones. This might be due to the fact that the senior students participate more social and organizational activities and have more recreation than the junior ones.

Moreover, the monthly allowance shows a positive coefficient which means that the higher allowance of the students, the more likely travels. For year level which also has a negative sign, the higher the year level, the less likely to travel. The results might be due to the fact that their fixed schedules of taking courses in school are less than the lower students. In type of accommodation, the positive sign shows that students residing near campus make more trips than those residing far from campus. In addition, for driver's license and vehicle ownership, the results are both positive coefficients. These coefficients show that students who own driver's license and vehicle are more likely to travel than who do not own license and vehicles.

Significant is typically measured by t-statistics or P-value in regression. These are t and $P > |t|$. Typically, a t-statistic above 1.96 is considered significant at the 95% level. The P-value describes the significant level of the coefficient. If it is significant at the 95% level, P-value is lesser than 0.05. If it is significant at the 99% level, P-value is lesser than 0.01.

The coefficients for gender, age, monthly allowance, driver's license ownership and vehicle ownership are not statistically significant at the 0.05 level since the t-statistics are less than 1.96 and the P-values are greater than 0.05. And then, the coefficients for year level and type of accommodation are statistically significant because the t-statistics are above 1.96, the P-value of 0.034 for year level is less than 0.05 and the P-value of 0.000 for type of accommodation is less than 0.01. Therefore, the coefficient for year level is significant at the 95% level and the coefficient for type of accommodation is significant at 99% level.

6. SUMMARY AND CONCLUSIONS

In order to understand the city's travel behaviour, studies in this line are essential. It is very much important to recognise the travel characteristics of individuals in a developing country like Myanmar, where the socio-economic attributes and the transportation problems are quite diverse. Activity-based travel demand modelling is a promising platform which can assist the town planners in formulating efficient demand management strategies to alleviate the transportation problems. Therefore, this study aimed at analysis of the activity-travel patterns

of university students. Data of 482 students from Technological University (kyaukse) activity travel survey was used for analysis.

The followings are conclusion that can be drawn from this study. Firstly, the average trip rate of students at Technological University (kyaukse) is around 8.0trips/day. Students use at least two travel modes when doing these activities. For travel mode, motorcycle is the most dominant mode of transportation used by the students. Students also prefer walking in short distances and also use ferry for long distances on their way to school. Secondly, multiple regression model revealed that year level and type of accommodation are important variables of students' trip rate. Thirdly, attending class has the highest percentage of activities, which is predictable to students as their main activity. Finally, going to school and traveling back to the accommodation allocate the highest travel time.

For determination of travel demand, the estimation of number of trips students make from their activities is needed. Therefore, results of this study can helpful for future travel demand modeling.

7. ACKNOWLEDGEMENTS

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