Exploring University Students' Activities and Travels based on Travel Diary Report

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Abstract: Knowledge on travel behaviors is usually accumulated using data from developed countries, while it is understand that developing countries have different characteristics and situations from developed countries. University students are one of the potential groups to start from to study travel behavior in developing countries. This study aims to explore activities conducted by university students with focus on their travel needs. Activities from four hundreds student in ten universities were collected in the city of Bandung, Indonesia using two days travel diary. Activities and travel characteristics of students are examined by considering gender, type of university (public and private), and type of day (weekday and weekend). Models are able to explain the student characteristics in term of travel and activity characteristics, i.e. number of trips per day, travel durations, number of activities, length of duration of activities, as well as travel costs.

Keywords: university student, activity, travel, developing country, travel diary

1. INTRODUCTION

In developing countries, a conventional travel demand modeling commonly applied in the planning process for determining alternatives for transportation infrastructure development as well as managing transportation operation. It is already well understood that this conventional travel demand modeling, i.e. four-step model, is appropriate mostly in the situation where the supply side approaches are more preferable. This trip-based model is sufficient where there are supports from the available institutional environment and resources (McNally, 2000).

Knowledge accumulated from research studies in this field shows that the conventional model lacks of information and nature of travel behavior of travelers. Transportation policy now also tends to be more sustainable in exploiting resources. Thus, more comprehensive approaches in exploring the behavior of travelers daily as well as multi-day grew since 1970. This was the beginning of activity-based approach.

Travel is understood as an effect of a need to participate in activities. Consequently, it is more important to understand activity behavior before trying to understand travel behavior (McNally, 2000). McNally and Rindt (2008) explained that the activity approach explicitly recognizes and addresses the inability of trip-based models to reflect underlying behavior and, therefore, their inability to be responsive to evolving policies oriented toward management versus expansion of transportation infrastructure and services. There is a large accumulation of research studies related to activity based travel analysis and modeling. One good discussion

is the work of Axhausen and Gärling (1992) where they discussed about the concept and model of activity scheduling and examined the behavioral aspects as well. The knowledge emphasizes the need to shift the modeling approaches to activity-based analysis. The reason is provided by Kitamura (1996) and Miller (2009) that activity-based can offer a coherent frameworks for policy analysis and demand forecasting with the wide range of travel demand management (TDM) and other policy measures.

As a fact, most studies about travel and its related activities are conducted using data from developed countries. One of the many studies is the work by Kuppam and Pendyala (2001) who explored the activities and travel patterns of commuters in Washington, DC in order to find the relationships among socio-demographics, activity participation, and travel behavior. Kitamura and Susilo (2006) examines the effect of stop in the journey to works using six week travel diary survey data from two cities in Germany, i.e. Karlsruhe and Halle. Ye at al. (2007) investigate the relationship between mode choice and the complexity of trip chaining patterns using work tour and non-work tour samples from Switzerland by developing causal structural models.

It is very rare to find study regarding activity based travel using data from developing countries. There were very limited study about daily activity patterns and its relationship with travel demand modeling. Even though studies by Yagi and Mohammadian (2008a and 2008b), were not using travel diary, it were an example of limited study about travel behavior using data from developing countries.

With this background, this study aims to explore the activities and its related travels conducted by university students based on two days travel diary, one working day and a weekend. Data were collected from students of five public and five private universities in the city of Bandung, Indonesia. This study explores the travel characteristics of university students and their activities using statistical analysis. As far as the authors aware, this study can be considered as the first effort in Indonesia to do a study using travel diary. As a first attempt in studying travel diary, this study provides basic knowledge to build the body of knowledge regarding activity based study using travel diary. Further study in Indonesia can be improved and advanced by learning the findings and practices in this study.

After this introduction, a brief discussion about travels and activities which were collected using travel diary are provided in section two. Section three presents data collection which consists of material, sample, and descriptive statistics. Section four presents data analysis and discussion. This article will be closed by conclusion.

2. TRAVELS AND ACTIVITIES USING TRAVEL DIARY REPORT

Many studies on activity based modeling have been conducted. A study by Jovicic (2001) reveals that activity based travel demand models rely on several paradigms. The first is a notion that demand of travel is derived from the activity participation, while the second and the third focus on sequences of activities where the activities are planned and executed in the household context. The forth paradigm assumes that activities are continuously spread along time. The last one assumes that travel choices are limited in time and space, as well as by personal constraints.

The fundamental concepts of activity analysis have been developed by many researchers. Hägerstrand (1970) and Jones (1979) can be considered as the pioneers. Hägerstrand proposed a time–geographic approach that delineated systems of constraints on activity participation in time and space. Since then, a big advancement has been built in modeling, simulation, as well as data collection in activity based modeling. Pas (1985) in Pas and

Harvey (1997) characterized several themes recurring in the body of work of activity-based approach, namely analysis of the demand for activity participation, the scheduling of activities in time and space, the constraints (spatio-temporal and interpersonal) on activity and travel-choice, the interactions between activity and travel decisions over the course of a day, and the structure of the household and the roles played by the various household members.

Furthermore, Mahmassani (1997) highlighted the inadequacy of conventional single-day surveys to study the dynamic process of commuter behavior. Thus, a new survey approaches and instruments are required to capture the dynamic behavior at the level of detail. Reason for this is a need for a sufficient data at the desired level of richness in order to develop a larger body of knowledge on the dynamic aspects of commuter behavior. Such data needs significant effort from the respondent, especially if detailed diaries are required (Mahmassani *et al.*, 1997).

During the 1980s, most surveys on travel behavior adopted some form of travel diary as the mechanism for collecting data (Purvis, 1990 in Stopher, 1997). The travel diary represented a procedure for collecting details of travel in a chronological manner for a 24-hours or longer day (Stopher, 1997). More detail discussion regarding the progress in developing travel diary can be found in Stopher (1997, 2009, and 2012) and Evert *et al.* (2006).

The progress in survey to capture travel behavior with its related activities, especially multi-days survey can be traced back several decades ago. Stopher and Sheskin (1982) discussed the development, design, administration, and costs of the diary technique. Brög et al. (1982) built a methodological experiment to disclose the problems of non-reported trips in surveys of non-home activity patterns. Hanson and Huff (1982) employed travel diaries collected over 35 consecutive days of Uppsala Household Travel Survey to find out empirical understanding regarding day-to-day variability in individuals' complex travel-activity patterns.

Travel diary has already been applied as a way to collect data for various applications, not only limited to analyzing travels and its related activities. Rose and Ampt (2001) reported a new approach in reducing car use to address environmental concerns using travel diaries over a nine-week period in Australia. Madre *et al.* (2004) studied the issues in the implementation of travel diary, i.e. when respondent reporting himself immobile on the reporting day.

Randall and Richard (1998) analyzed household travel diary and GIS data for San Diego to find the role for land use in explaining travel behavior. Furthermore, several recent pilot studies have combined Global Positioning System (GPS) technology with travel survey data collection to evaluate opportunities for improving the quantity and accuracy of travel data. Wolf (2000) and Wolf *et al.* (2001) used GPS to supplement traditional data elements collected in paper or electronic travel diaries. Wolf *et al.* (2000) also reported the use of electronic travel diaries and vehicle instrumentation packages in Atlanta Regional Household Travel Survey.

Furthermore, studies about travel behavior of students are important. It is believed that the future behavior of a person in traveling is influenced by the previous behavior in traveling (see Lansendorf (2003) and Simma and Axhausen (2003)). Thus it is important to understand travel behaviors of youngsters, as a way to predict and anticipated travel behavior in the future. The understanding is basic in developing future policy. As a matter of fact, some studies explored travel behaviors of students, as an example are the works of Field (1999), Ewing *et al.* (2004), Gallarza and Saura (2006), or Xu *et al.* (2009), where all of them using data from developed countries.

It can be concluded from the literature, as far as the authors aware, there is no report of

the implementation of travel diary in developing countries. It is a challenge to conduct this kind of research to experience and supplement activity based travel survey in analyzing travel behavior in developing countries. This kind of study is fundamental for future study in this field, especially in developing countries, such as Indonesia.

3. DATA COLLECTION

3.1 Travel Diary

A travel diary survey was prepared to collect respondents' daily activities and travels for weekday and weekend as well. The questionnaire consisted of three parts. First part requested respondents to identify their detailed address, while second part consisted of social demography questions such as gender, position at the household, driving license ownership, education, and travel characteristics. The last part was a form to report type of activities, location, beginning and ending time of activities, type of modes, travel times, and travel costs. In this form, the respondents were provided a maximum of forty slots of activities and travels for their 24 hours duration.

In developing a reliable and easily understandable form, several discussions, reviews, and improvements had been conducted before the final one. The draft was also tested in pilot surveys to get more input from respondents regarding wording, layout, flow of questions, as well as graphical design of questionnaire. The final design of questionnaire was presented in Figure 1.

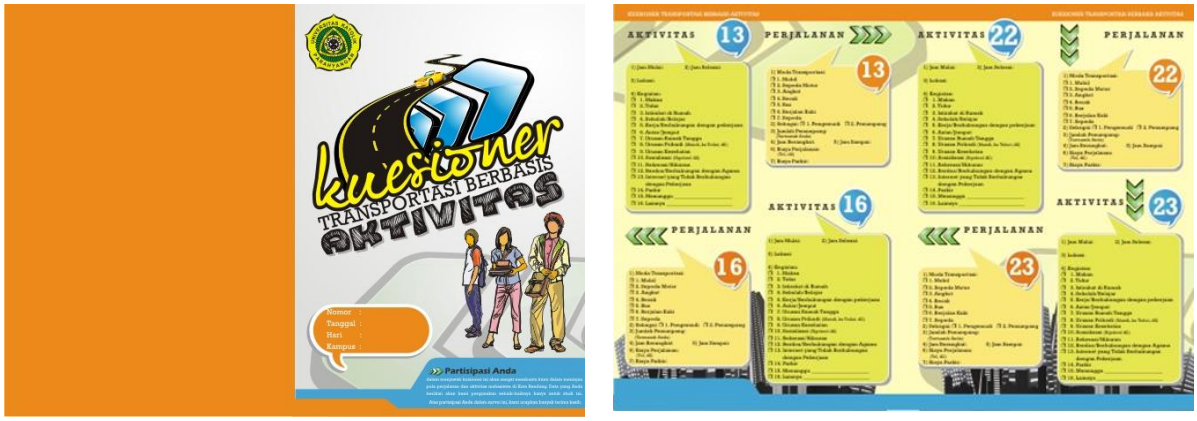

Figure 1 Graphical design of the travel diary questionnaire (Joewono and Santoso, 2012)

3.2 Sample Selection

Since there are hundreds of colleges and universities in the City of Bandung, Indonesia, sample was collected from ten universities, consists of five public universities and five private universities. The size of student body in these colleges and universities spreads from hundreds to more than ten thousand students. Even though there is no formal evidence, but the authors believed that these selected universities are a valid representative. These universities were the

top five public universities and the top five private universities in terms of the size of student body (number of total students). The authors only refers to the size of student body, while there were no literature in explaining students travel behavior from previous studies. Selection of public and private universities are believed reduced the possibility of bias.

Using guideline in sample size determination from Israel (2012) and total number of university students in Bandung of 130.744 students, it was estimated that the required sample size was 400 respondents. This number was distributed proportionally based on the size of student body of each university as shown in Table 1.

Table 1 Number of student and sample size (Joewono and Santoso, 2012)

Public University			Private University		
University	Student Body*	Sample Size	University	Student Body*	Sample Size
UPI	39.231	120	UNPAS	12.758	39
UNPAD	19.254	59	Maranatha	10.494	32
ITB	16.674	51	UNIKOM	10.172	31
POLBAN	4.163	13	UNPAR	9.839	30
POLMAN	795	2	LP3I	7.364	23

*Source: Directorate General of Higher Education , 2012

The survey of trip diary was assisted by 21 questionnaire administrators who came from each selected university. Each university has different number of questionnaire administrators which was proportional to the sample size. A briefing was provided for all questionnaire administrators on Friday, 1 June 2012 to explain the background, the idea, method of approach, procedure to fill in the travel diary questionnaire, as well as a form to make a note of number of rejection and acceptance by respondent (to calculate hit ratio). Each questionnaire administrator was equipped with travel diary questionnaires and administrator's report where information of survey and respondents were recorded.

Each questionnaire administrator personally approached the targeted respondents at common gathering places for students, such as cafetaria or student center within the campus area. Each respondent was asked to report their travels and activities for 24 hours in one workday as well as one weekend or holiday. When the targeted respondent agreed to continue, a set of questionnaire were provided to him/her. After s/he completely filled in the travel diary form at home for one selected day, the administrator came to collect the filled questionnaire and handed the second set of questionnaire. Respondent can freely select the time to start to record the diary. After s/he completed the questionnaire, the administrator came again at the scheduled date to collect the filled questionnaire. With this procedure, questionnaire administrator met the respondents three times, where the second meeting was intended as a reminder to respondent as well as reveiwing the completeness of the filled questionnaire. After each respondent completed questionnaire for both days, they were provided some amount of 'thank-you money'. With this approach, a response rate of 90% can be obtained. Detailed description regarding the process of collecting travel diary report from respondents can be found in Joewono and Santoso (2012).

3.3 Data Description regarding Characteristics of Respondent

This travel diary survey has been responded by 400 university students, where each of them filled in the survey two times, i.e. one workday and one weekend. After reviewing the completeness, only 784 sets, which come from 392 respondents, can be used for further

analyses. In terms of gender, the share of respondents is almost equal, with 51% of them are male. Majority of them (98%) are between 17 and 29 years old. The respondents are dominated by student in bachelor degree (85.6%) and diploma (12.1%). The share of graduate student in this survey is very small and it is a common situation in many Indonesian universities.

In this survey, respondents reported that they only have one driving license, namely for motorcycle (Type C) as much as 33.3% and for passenger car (Type A) as much as 5.6%. There are 18.4% of respondents have driving licenses both for car and motorcycle (Type A and C), while 41.3% of them do not have any driving license. Analysis shows that there is significant difference regarding the distribution of driving license's ownership between male and female (χ^2 =182.995; df = 4, p-value = 0.000), as well as between public and private university (χ^2 =34.841; df = 5, p-value = 0.000).

Most of the student in this study state that they do not have any car (63.1%), while 23.1% of students have one unit of car. In the ownership of motorcycle, 45.4% of students own one unit and 16.8% own two units. Only 28.8% of students do not have any motorcycle. In majority, students do not have any bicycle (85.2%). Regarding access to public transport, 17% of them have an access to one type of public transport, while 39% and 27.4% of them have an access to use two and three types of public transport.

Analysis shows that there is significant difference in the number of car ownership between public and private university (χ^2 =35.303; df = 4, p-value = 0.000). However, when number of motorcycle and bicycle ownership is explored between private and private universities, no significant differences was found in the number of motorcycle (χ^2 =8.777; df = 4, p-value = 0.067) as well as the number of bicycle (χ^2 =4.117; df = 3, p-value = 0.249). Since students in private or public universities experiences the same existing services of public transport and the location of the universities are relatively close to each other and located around city center, then, it is easy to understand that there is no significant different in number of access to public transport between students from public and private university (χ^2 =14.725; df = 5, p-value = 0.012).

4. DATA ANALYSIS

4.1 Comparing Travel Characteristics

In this section, comparison analyses was reported. The comparison analyses was conducted to explore the travel characteristics between male and female, private and public, as well as between weekday-workday. The comparisons are useful to find out whether there is unique characteristic of student behavior. If there is no difference, then an aggregate analyses can be conducted without considering gender, type of university, and type of day. But, on the other hand, when there is significant difference, further analyses should be conducted by considering those factors.

Table 2 shows the distribution of trips number to campus per week. Most of students have five or six trips per week. It is found that there is significant different in the distribution of number of trips between male and female, as well as type of university. Table 3 provides the distribution of the number of alternative routes. Alternative route in this study refers to the number of possible way (path) in the city's road network to reach destination (university) from the origin (home). Numbers of alternative routes seem as do not varied significantly between gender and type of university. It implies that the access to campus can be reached in similar level of easiness.

Frequency of mode usage per day is an important information for mode choice and usage of university student. Table 4 presents the result of comparison of the frequency of usage for different type of mode, where it is explained by the value of t-test and its p-value. This table explains that only bus and walking is experienced differently between student in private and public university, while other modes are used in similar degree of usage. In term of duration of mode usage per day, it is found that there are no significant different between student in private and public university for all type of mode in Bandung.

Table 2 Distribution of Number of Trips to Campus per Week

Number of trips to campus per week	Gender		Type of University	
	Male	Female	Public	Private
1	4	2	2	4
2	14	8	14	8
3	32	24	40	16
4	63	83	105	41
5	137	155	187	105
6	144	110	126	128
χ^2; df.; p-value	11.664; 5; 0.040		26.884; 5; 0.000	

Table 3 Distribution of Number of Alternative Routes to Reach University

Number of alternative routes	Gender		Type of University	
	Male	Female	Public	Private
1	84	74	84	74
2	175	189	231	133
3	89	67	99	57
4	16	22	26	12
5	4	6	4	6
6	24	22	28	18
χ^2; df.; p-value	5.523; 5; 0.355		8.140; 5; 0.149	

Table 4 Comparisons of Modes' Usage Frequency and Duration between Type of University

Frequency of Usage	t-stat (p-value)	Duration of Usage	t-stat (p-value)
Car	0.440 (0.660)	Car	0.393 (0.694)
Motorcycle	-0.696 (0.486)	Motorcycle	-0.134 (0.894)
Paratransit	0.660 (0.509)	Paratransit	0.335 (0.738)
Rickshaw	1.416 (0.158)	Rickshaw	1.349 (0.178)
Bus	2.230 (0.026)*	Bus	1.605(0.109)
Walking	4.328(0.000)*	Walking	0.429 (0.668)
Bicycle	-0.999(0.318)	Bicycle	-0.712 (0.477)

*significant at 5%

When the frequency of mode usage is compared between male and female, it is found that motorcycle, paratransit, and walking are used with different frequency. The complete result is presented in Table 5. It is also found that the duration in using motorcycle and paratransit is significantly different between male and female.

The comparison of the frequency and duration of mode usage is also conducted between workday and weekend as can be seen in Table 6. Student in workday and weekend have different frequency in making use of car and walking. On the other hand, the duration in using car is different between workday and weekend. These findings imply the possibility of different activities between study-day (workday) and break-time (weekend).

Several travel characteristics are also compared between type of university, gender, and

type of day as appears in Table 8, while its desriptive statistics are provided in Table 7. Number of trips per day can be identified as a sole travel characteristic that significantly differ between male-female, private-public, and workday-weekend. Students from private and public universities spent significantly different in the amount of money for their travel needs. Money spent for parking is significantly different between male and female students, as well as between workday and weekend.

Table 5 Comparisons of Modes' Usage Frequency and Duration between Gender

Frequency of Usage	t-stat (p-value)	Duration of Usage	t-stat (p-value)
Car	1.023 (0.307)	Car	0.827 (0.408)
Motorcycle	6.842 (0.000)*	Motorcycle	3.651 (0.000)*
Paratransit	-7.174 (0.000)*	Paratransit	-6.928 (0.000)*
Rickshaw	-0.022 (0.983)	Rickshaw	-0.450 (0.653)
Bus	-1.448 (0.147)	Bus	-0.457 (0.148)
Walking	-5.460 (0.000)*	Walking	1.011 (0.313)
Bicycle	1.843 (0.066)	Bicycle	1.166 (0.244)

*significant at 5%

Table 6 Comparisons of Modes' Usage Frequency ad Duration between Type of Day

Frequency of Usage	t-stat (p-value)	Duration of Usage	t-stat (p-value)
Car	-3.232 (0.001)*	Car	-3.580 (0.000)*
Motorcycle	1.455 (0.146)	Motorcycle	-0.496 (0.620)
Paratransit	1.742 (0.082)	Paratransit	0.664 (0.507)
Rickshaw	0.000 (1.000)	Rickshaw	0.429 (0.668)
Bus	0.373 (0.709)	Bus	-0.366 (0.714)
Walking	2.073 (0.038)*	Walking	0.381 (0.704)
Bicycle	-0.807 (0.420)	Bicycle	-1.759 (0.079)

*significant at 5%

Table 7 Descriptive Statistics of Travel Characteristics of the Students

	Variables		Number of trips per day	Length of trip duration per day (min.)	Cost of travel per day (IDR)	Cost of parking per day (IDR)
Type of University	Public (N=478)	Mean	18.92	137.01	4455.86	1246.18
		St. Dev.	8.221	136.522	15669.768	2912.106
	Private (N=306)	Mean	16.12	129.43	2786.38	1553.72
		St. Dev.	9.178	119.707	7047.652	3073.675
Gender	Male (N=394)	Mean	16.51	139.17	3710.49	1600.59
		St. Dev.	8.199	150.794	16275.846	3304.950
	Female (N=382)	Mean	19.18	128.97	3906.31	1112.78
		St. Dev.	9.010	105.248	8630.457	2526.898
Type of Day	Workday (N=392)	Mean	18.48	126.17	3213.03	1040.30
		St. Dev.	9.021	111.364	7817.798	2487.723
	Weekend (N=392)	Mean	17.19	141.94	4395.48	1692.13
		St. Dev.	8.348	146.344	16667.451	3370.238

Table 8 Comparisons of Travel Characteristics

Trip Characteristics	t-stat (p-value)		
	Between Type of University	Between Gender	Between Type of Day
Number of trips per day	4.444 (0.000)*	-4.329 (0.000)*	2.079 (0.038)*
Length of trip duration per day	0.795 (0.427)	1.089 (0.276)	-1.698 (0.090)
Cost of travel per day	2.031 (0.043)*	-0.208 (0.835)	-1.272 (0.204)
Cost of parking per day	-1.395 (0.164)	2.314 (0.021)*	-3.081 (0.002)*

*significant at 5%.

4.2 Comparing Activity Characteristics

From the trip diary, 17 activities were reported. Each activity is explained by its frequency per day and its duration (minutes per day) and it were also compared between type of university, gender, and type of day. Table 9 reports the comparison of the frequency of activity per day between these three categories. Eating, socialization, recreation, praying, browsing internet, and waking up activities are found to be different between students of public and private universities at 5% significance level. Between this category, it is also found that personal matter is significantly diifferent. Different findings can be found when comparison is conducted between genders. It is found that the frequency per day of dropping by, personal matter, domestic matter, health, praying, parking, and waiting are different between male and female. Furthermore, eating, sleeping, studying, health related activities, socializing, recreation, and waiting are found different between workday and weekend.

Table 9 Comparisons of Activity Frequency

Frequency of Activity	t-stat (p-value)		
	Between Type of University	Between Gender	Between Type of Day
Eating	2.440 (0.015)*	-0.254 (0.800)	3.231 (0.001)*
Sleeping	0.017 (0.986)	0.410 (0.682)	-2.375 (0.018)*
Resting	-0.188 (0.851)	-0.570 (0.569)	-0.472 (0.637)
Studying	1.422 (0.156)	-1.778 (0.076)	13.382 (0.000)*
Working	1.444 (0.149)	0.106 (0.915)	0.537 (0.591)
Dropping by	-0.206 (0.837)	4.120 (0.000)*	-0.954 (0.341)
Domestic matter	-0.476 (0.634)	-5.951 (0.000)*	-1.191 (0.234)
Personal matter	1.934 (0.053)*	-3.331 (0.001)*	0.467 (0.641)
Health	-1.725 (0.085)	2.101 (0.036)*	-2.422 (0.016)*
Socializing	2.087 (0.037)*	1.612 (0.107)	3.691 (0.000)*
Recreation	-2.508 (0.012)*	1.713 (0.087)	-6.547 (0.000)*
Praying	2.077 (0.038)*	-4.190 (0.000)*	0.294 (0.769)
Browsing internet	3.808 (0.000)*	1.896 (0.058)	-0.653 (0.514)
Parking	0.554 (0.580)	3.658 (0.000)*	1.791 (0.074)
Waiting	0.988 (0.324)	-5.418 (0.000)*	3.710 (0.000)*
Waking up activities	-4.061 (0.000)*	-0.891 (0.373)	-0.325 (0.745)
Others	7.431 (0.000)*	-5.951 (0.000)*	-0.323 (0.747)

*significant at 5%.

In terms of the duration of each activity, students from private and public universities spent significantly different duration for the activities related to health, recreation, and browsing internet. The results are presented in Table 10. It also shows that male and female students spent time differently for working, dropping by, domestic matter, personal matter, health, sozializing, recreation, browsing internet, and waiting. Students also spent time differently between weekday and weekend for the following activities, i.e. domestic matter, health, recreation, browsing internet, and waiting.

Table 10 Comparisons of Activity Duration

Duration of Activity	t-stat (p-value)		
	Between Typeof University	Between Gender	Between Typeof Day
Eating	0.147 (0.883)	-1.185 (0.236)	0.661 (0.509)
Sleeping	1.308 (0.191)	-0.453 (0.651)	-1.931 (0.054)
Resting	-0.605 (0.545)	0.104 (0.917)	-1.576 (0.115)
Studying	-0.701 (0.484)	-0.673 (0.501)	15.064 (0.000)
Working	0.282 (0.778)	1.904 (0.057)	-0.108 (0.914)
Dropping by	-0.282 (0.778)	2.460 (0.014)*	-1.480 (0.139)
Domestic matter	1.080 (0.281)	-4.721 (0.000)*	-3.606 (0.000)*
Personal matter	-1.469 (0.142)	-2.862 (0.004)*	-0.446 (0.655)
Health	-2.158 (0.031)*	2.286 (0.023)*	-1.982 (0.048)*
Socializing	-0.539 (0.590)	3.412 (0.001)*	1.916 (0.056)
Recreation	-2.944 (0.003)*	4.055 (0.000)*	-7.876 (0.000)*
Praying	-0.460 (0.646)	-0.060 (0.952)	-1.010 (0.313)
Browsing internet	2.219 (0.027)*	3.903 (0.000)*	-2.391 (0.017)*
Parking	0.787 (0.432)	0.170 (0.865)	-0.563 (0.574)
Waiting	-0.370 (0.711)	-2.235 (0.026)*	2.271 (0.023)*
Waking up activities	0.444 (0.657)	1.695 (0.091)	-0.974 (0.330)
Others	5.626 (0.000)*	-4.551 (0.000)*	-2.231 (0.026)*

*significant at 5%.

4.3 Model Estimation

Several models were estimated using multiple linear regression to explain the travel behavior of university students based on their daily activities. Multiple linear regression was selected as the dependent variables were continuously distributed even with different wideness, where some variables were not wide enough. Thus it can be assumed that the approach is acceptable. Parameters estimate for travel duration using multiple linear regression is provided in Table 11. The model retains all significant variabels at 5%. If it is not possible, the selected variable should be significant at 10%. Some non-significant variabels are retained at least for one category to explain the influence. Some social demographic variables are not significant and excluded in the model, most probably because the samples have similar social demographic characteristics.

Model estimate shows that respondents, who are not undergraduate students, tend to have higher travel duration. Students spend shorter duration in traveling on weekday than on weekend, may be due to their commitment in educational activities. Student also travels shorter duration when they have more alternative routes, which implies that they can select more efficent routes. In terms of the number of motorcycle ownership, all numbers of motorcycle ownership by student are significant. Student seems to spend longer duration of

travel using the available mode, which implies the level of accessibility. It is also interesting to find that the numbers of available modes are important factors in defining travel duration.

Table 11 Parameters Estimate for Travel Duration

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	138.085	34.989		3.947	.000
Weekday (Dummy, 1 = yes, 0 = otherwise)	-16.507	9.132	-.063	-1.808	.071
Education is Bachelor degree (Dummy, 1 = yes, 0 = otherwise)	-28.568	13.046	-.079	-2.190	.029
Number of alternative routes are five (Dummy, 1 = yes, 0 = otherwise)	-67.487	41.458	-.058	-1.628	.104
Do not have any motorcycle (Dummy, 1 = yes, 0 = otherwise)	-129.214	33.581	-.445	-3.848	.000
Own one unit of motorcycle (Dummy, 1 = yes, 0 = otherwise)	-109.092	33.284	-.416	-3.278	.001
Own two units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	-111.632	34.650	-.316	-3.222	.001
Own three units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	-125.700	38.704	-.207	-3.248	.001
Own more than four units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	-132.037	40.047	-.198	-3.297	.001
One mode is available(Dummy, 1 = yes, 0 = otherwise)	131.158	45.477	.376	2.884	.004
Two modes are available (Dummy, 1 = yes, 0 = otherwise)	131.517	44.823	.491	2.934	.003
Three modes are available (Dummy, 1 = yes, 0 = otherwise)	154.946	45.519	.527	3.404	.001
Four modes are available (Dummy, 1 = yes, 0 = otherwise)	146.882	47.577	.307	3.087	.002
Five modes are available (Dummy, 1 = yes, 0 = otherwise)	190.935	47.309	.341	4.036	.000
More than five modes are available (Dummy, 1 = yes, 0 = otherwise)	224.832	53.398	.272	4.211	.000
R-square	0.056				
F; p-value	3.260; 0.000				

The model in defining the number of trips per day is shown in Table 12. Student seems travel more frequent in weekday than weekend. This finding can be related with finding in Table 11, where the finding explain each other. It can be inferred that student in weekday travels more frequent with shorter duration in traveling. It is understandable since in weekday, student have more activity, especially related with their main activity. It is also found that the student in the age of 17-29 years old travels less frequent than 30-39 years old. Undergraduate students travel less frequent than other degrees, while male students travel more frequent than female students. This is also the case if the student still lives with his/her parents.

Students tend to travel less frequent when there is more number of available alternative routes. Students with one unit of motorcycle or automobile tend to have higher number of trips per day. This finding can be complemented by findings in Table 11. These findings implies the possibility that student in this study seems to travel with their main mode, where they focus on the main mode only. They travel longer with theirs selected mode, and become rarely change to other alternative even when there are more alternative. Thus they traveled longer in their main mode only. It is also interesting to find that students from public university tend to travel more frequent than their counterpart in private university.

Table 12 Parameters Estimate for Total Number of Trips per Day

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6.144	5.061		1.214	.225
Weekday (Dummy, 1 = yes, 0 = otherwise)	1.297	.571	.075	2.273	.023
Age between 17 – 29 years old (Dummy, 1 = yes, 0 = otherwise)	5.887	3.068	.073	1.919	.055
Age between 30 – 39 years old (Dummy, 1 = yes, 0 = otherwise)	19.206	6.554	.112	2.931	.003
Male (Dummy, 1 = yes, 0 = otherwise)	1.753	.658	.101	2.665	.008
Position at household as children (Dummy, 1 = yes, 0 = otherwise)	7.040	3.332	.071	2.113	.035
Do not have any driving license (Dummy, 1 = yes, 0 = otherwise)	1.113	.673	.063	1.653	.099
Education is bachelor degree (Dummy, 1 = yes, 0 = otherwise)	-6.326	.835	-.256	-7.573	.000
Number of trip per day is one (Dummy, 1 = yes, 0 = otherwise)	-7.731	3.287	-.078	-2.352	.019
Number of trips per day are three (Dummy, 1 = yes, 0 = otherwise)	-2.107	1.123	-.063	-1.875	.061
One alternative route is available (Dummy, 1 = yes, 0 = otherwise)	3.616	2.283	.167	1.584	.114
Two alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	4.690	2.224	.269	2.108	.035
Three alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	4.171	2.270	.193	1.838	.066
Four alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	6.481	2.540	.161	2.551	.011
More than five alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	6.473	2.485	.176	2.605	.009
Own one unit automobile (Dummy, 1 = yes, 0 = otherwise)	1.275	.724	.061	1.761	.079
Own two units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	1.723	.803	.073	2.146	.032
Do not have any bicycle (Dummy, 1 = yes, 0 = otherwise)	-3.160	.794	-.137	-3.979	.000
Two modes are available (Dummy, 1 = yes, 0 = otherwise)	-1.425	.803	-.080	-1.774	.076
Three modes are available (Dummy, 1 = yes, 0 = otherwise)	-1.893	.862	-.097	-2.197	.028
Four modes are available (Dummy, 1 = yes, 0 = otherwise)	-3.149	1.212	-.099	-2.598	.010
Five modes are available (Dummy, 1 = yes, 0 = otherwise)	-4.529	1.398	-.122	-3.239	.001
As a student of public university (Dummy, 1 = yes, 0 = otherwise)	2.699	.615	.151	4.391	.000
R-square			0.193		
F; p-value			8.168; 0.000		

Based on travel diary, it is possible to gather information regarding duration of activity which parameters estimate is presented in Table 13. Students in the age of 17-29 years old tend to spend more time for activity than other groups of age. It is also the case for students

with multiple type of driving license, but not for students with diploma or vocational degree. This implies that younger student have more willingness to try many things, which influences their travel behaviors. Students who have four alternative routes tend to have longer duration of activities, while students with three or five alternative routes tend to have shorter duration of activities. This finding implies that student with higher activities tends to focus on usual or daily routes. On the other hand, student with less activities tend to like more on findings new alternative routes, which results in knowing more alternative routes. The most probable reasons is the time availability to findings alternative routes. Any numbers of automobile ownerships tend to have longer duration of activities per day. The same trend can be found for more number of motorcycles. It is interesting to know that student with more number of bicycles have longer duration of activities. It is also found that student from public university tend to spend more duration time of activities.

In the case of number of activities per day, a multiple linear regression model was developed as shown in Table 14. Students' activities in weekday significantly contribute in the numbers of activities per day. This is also the case for male students. Students in the age range of 17-29 years old seem to have less influence in the number of activities than student in the age of 30-39 years old. The numbers of automobile or motorcycle ownerships significantly influence the numbers of activities. Students with more bicycles in the household tend to involve in less numbers of activities. Students from private universities tend to have less number of activities per day. It is in line with the findings from previous models.

Total travel costs spent by students were also explored from the available attributes (Table 15). Students tend to spend less cost for their activities on weekday than weekend. Students who have no driving licenses need to spend more for their travel. It is also understandable that students with more number of trips per day spend more money for their travel. Similar situation can be found in the number alternative modes, where student with more number of alternative modes spend lower cost. When the alternative routes are less, students spend higher costs to reach campus. These two variables, number of alternative modes and routes, imply the accessibility to reach destination. Students with higher accessibility tend to spend less cost. In line with other models, students from public university tend to spend higher costs for their travel than students from private universities.

Table 13 Parameters Estimate for Total Duration of Activity

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2051.394	251.140		8.168	.000
Age between 17 – 29 years old (Dummy, 1 = yes, 0 = otherwise)	350.775	204.832	.063	1.712	.087
Own several types of driving licenses (Dummy, 1 = yes, 0 = otherwise)	112.449	59.068	.074	1.904	.057
Education is diploma / vocational (Dummy, 1 = yes, 0 = otherwise)	-168.241	67.246	-.092	-2.502	.013
Number of trips per day are two (Dummy, 1 = yes, 0 = otherwise)	-265.552	127.425	-.074	-2.084	.037
Three alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	-159.145	54.631	-.107	-2.913	.004
Four alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	174.344	99.422	.063	1.754	.080
More than five alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	-159.611	92.265	-.063	-1.730	.084
More than five modes are available (Dummy, 1 = yes, 0 = otherwise)	-249.956	138.858	-.066	-1.800	.072
Do not have any automobile (Dummy, 1 = yes, 0 = otherwise)	-420.775	246.264	-.343	-1.709	.088
Own one unit of automobile (Dummy, 1 = yes, 0 = otherwise)	-506.031	249.993	-.354	-2.024	.043
Own two units of automobile (Dummy, 1 = yes, 0 = otherwise)	-466.959	257.343	-.218	-1.815	.070
Own three units of automobile (Dummy, 1 = yes, 0 = otherwise)	-403.915	283.059	-.102	-1.427	.154
Own more than four units of automobile (Dummy, 1 = yes, 0 = otherwise)	-427.111	282.618	-.113	-1.511	.131
Do not have any motorcycle (Dummy, 1 = yes, 0 = otherwise)	644.771	284.757	.485	2.264	.024
Own one unit of motorcycle (Dummy, 1 = yes, 0 = otherwise)	761.899	285.340	.634	2.670	.008
Own two units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	770.340	288.563	.477	2.670	.008
Own three units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	580.137	291.725	.210	1.989	.047
Own more than four units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	775.055	304.692	.254	2.544	.011
Do not have any bicycle (Dummy, 1 = yes, 0 = otherwise)	-262.386	117.594	-.165	-2.231	.026
Own one unit of bicycle (Dummy, 1 = yes, 0 = otherwise)	-179.963	127.541	-.092	-1.411	.159
As a student of public university (Dummy, 1 = yes, 0 = otherwise)	76.625	45.460	.063	1.686	.092
R-square			0.079		
F; p-value			3.071; 0.000		

Table 14 Parameters Estimate for Number of Activity

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	14.930	3.672		4.066	.000
Weekday (Dummy, 1 = yes, 0 = otherwise)	1.530	.569	.087	2.687	.007
Age between 17 – 29 years old (Dummy, 1 = yes, 0 = otherwise)	9.232	3.216	.113	2.870	.004
Age between 30 – 39 years old (Dummy, 1 = yes, 0 = otherwise)	27.460	6.562	.159	4.185	.000
Male (Dummy, 1 = yes, 0 = otherwise)	2.407	.611	.137	3.939	.000
Not as a main member of family (relatives) (Dummy, 1 = yes, 0 = otherwise)	-13.039	5.771	-.076	-2.259	.024
Education is bachelor degree (Dummy, 1 = yes, 0 = otherwise)	-7.196	.845	-.289	-8.515	.000
Number of trip per day is one (Dummy, 1 = yes, 0 = otherwise)	-6.777	3.372	-.068	-2.010	.045
Number of trips per day are three (Dummy, 1 = yes, 0 = otherwise)	-1.993	1.135	-.059	-1.756	.080
Do not have any automobile (Dummy, 1 = yes, 0 = otherwise)	6.856	3.101	.381	2.211	.027
Own one unit of automobile (Dummy, 1 = yes, 0 = otherwise)	6.560	3.152	.313	2.082	.038
Own two units of automobile (Dummy, 1 = yes, 0 = otherwise)	5.338	3.224	.170	1.656	.098
Own three units of automobile (Dummy, 1 = yes, 0 = otherwise)	5.223	3.621	.090	1.442	.150
Own more than four units of automobile (Dummy, 1 = yes, 0 = otherwise)	6.387	3.584	.116	1.782	.075
Do not have any motorcycle (Dummy, 1 = yes, 0 = otherwise)	2.402	1.163	.123	2.064	.039
Own one unit of motorcycle (Dummy, 1 = yes, 0 = otherwise)	2.250	1.111	.128	2.025	.043
Own two units of motorcycle (Dummy, 1 = yes, 0 = otherwise)	3.087	1.223	.131	2.524	.012
Do not have any bicycle (Dummy, 1 = yes, 0 = otherwise)	-10.193	3.216	-.438	-3.169	.002
Own one unit of bicycle (Dummy, 1 = yes, 0 = otherwise)	-6.924	3.283	-.241	-2.109	.035
Own two units of bicycle (Dummy, 1 = yes, 0 = otherwise)	-6.354	3.454	-.136	-1.839	.066
Own three units of bicycle (Dummy, 1 = yes, 0 = otherwise)	-10.327	5.146	-.085	-2.007	.045
Five modes are available (Dummy, 1 = yes, 0 = otherwise)	-2.787	1.241	-.075	-2.245	.025
As a student of public university (Dummy, 1 = yes, 0 = otherwise)	3.225	.616	.180	5.240	.000
R-square			0.207		
F; p-value			8.878; 0.000		

Table 15 Parameters Estimate for Total Cost of Daily Travels

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6912.890	3778.531		1.830	.068
Weekday (Dummy, 1 = yes, 0 = otherwise)	-1189.430	916.923	-.046	-1.297	.195
Do not have any type of driving license (Dummy, 1 = yes, 0 = otherwise)	1335.154	957.374	.050	1.395	.164
Number of trips per day are more than five (Dummy, 1 = yes, 0 = otherwise)	3621.427	1020.671	.130	3.548	.000
One alternative route is available (Dummy, 1 = yes, 0 = otherwise)	-5661.197	3882.613	-.174	-1.458	.145
Two alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	-5368.920	3805.069	-.206	-1.411	.159
Three alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	-8305.357	3890.380	-.255	-2.135	.033
Four alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	-8371.609	4304.052	-.138	-1.945	.052
Five alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	-7223.859	5548.240	-.062	-1.302	.193
More than five alternative routes are available (Dummy, 1 = yes, 0 = otherwise)	-6672.581	4232.969	-.120	-1.576	.115
Three modes are available (Dummy, 1 = yes, 0 = otherwise)	1919.885	1083.490	.065	1.772	.077
Five modes are available (Dummy, 1 = yes, 0 = otherwise)	5559.541	2054.888	.099	2.706	.007
More than five modes are available (Dummy, 1 = yes, 0 = otherwise)	7544.438	3009.110	.091	2.507	.012
Own two units of automobile (Dummy, 1 = yes, 0 = otherwise)	-3378.803	1702.030	-.072	-1.985	.047
As a student of public university (Dummy, 1 = yes, 0 = otherwise)	1963.919	982.473	.074	1.999	.046
R-square			0.048		
F; p-value			2.779; 0.000		

5. CONCLUSIONS

This study explores the characteristics of travels and its related activities from travel diaries of students in ten universities. After conducting comparison analysis, it can be inferred that there is difference in travel characteristics according to gender, type of university, and time of day.

In this study, 17 types of common activities for university students were identified. Each activities are explained by its frequency per day and length of duration. The frequency per day of the activities of eating, socialization, recreation, praying, browsing internet, and waking up activities are conducted significantly different by student of private and public university. On the other hand, the frequency per day of dropping by, personal matter, domestic matter, health, praying, parking, and waiting are experienced differently male and female. Furthermore, eating, sleeping, studying, health related activities, socializing, recreation, and waiting are found different between workday and weekend.

When the travel diary between students from public and private university are compared, it is found that the activities of health related, recreation, and browsing internet have different duration per day. From the perspective of gender, significant different duration can be

observed in the activities of working, dropping by, domestic matter, personal matter, health, socializing, recreation, browsing internet, and waiting. Analyses are also completed for duration of activity between types of day. Activities such as sleeping, learning, domestic matter, health, socializing, recreation, browsing internet, and waiting are found as different in duration per day.

The findings from several models are found as able to provide better understanding regarding the relation of travel characteristics and students activities. Each model complements each other to improve the understanding.

Analyses show that younger students and having multiple type of driving licenses tend to spend more time for activity. This implies that younger student have more willingness to try many things, which influences their travel behaviors. Analyses show that students with higher activities tends to focus on usual routes. On the other hand, student with less activities tend to like more on findings alternative routes. The most probable reasons is the time availability to findings alternative routes. Any numbers of automobile ownerships tend to have longer duration of activities per day. The same trend can be found for more number of motorcycles. It is interesting to know that student with more number of bicycles have longer duration of activities. It is also found that student from public university tend to spend more duration time of activities.

Study shows that students spend shorter duration in traveling on weekday than on weekend. This may be due to their commitment in educational activities. Student also travels shorter duration when they have more alternative routes, which implies that they can select more efficent routes. Student seems to spend longer duration of travel using the available mode, which implies the level of accessibility. It is also interesting to find that the numbers of available modes are important factors in defining travel duration.

Students tend to travel less frequent when there is more number of available alternative routes. Students with one unit of motorcycle or automobile tend to have higher number of trips per day. These findings implies the possibility that student in this study seems to travel with their main mode, where they focus on the main mode only. They travel longer with theirs selected mode, and become rarely change to other alternative even when there are more alternative. Thus they traveled longer in their main mode only. It is also interesting to find that students from public university tend to travel more frequent than their counterpart in private university.

Students tend to spend less cost for their activities on weekday than weekend. Students who have no driving licenses need to spend more cost for their travel. It is also understandable that students with more number of trips per day spend more money for their travel. Similar situation can be found in the number alternative modes, where student with more number of alternative modes spend lower cost. When the alternative routes are less, students spend higher costs to reach campus. These two variables, number of alternative modes and routes, imply the accessibility to reach destination. Students with higher accessibility tend to spend less cost. In line with other models, students from public university tend to spend higher costs for their travel than students from private universities.

It can be concluded that the model provides basic knowledge regarding travel characteristics and its relation with activities characteristics of student in developing city. This basic findings can be used as a foundation for further study in travel behavior, especially in activity based study using travel diary.

ACKNOWLEDGMENT

This study is funded by Competitive Grant from the Directorate General of Higher Education, Ministry of Education and Culture, Republic of Indonesia, in 2012. The authors also express their appreciation to all parties who participate in data collection.

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