ACTIVE COMMUTING TO THE UNIVERSITY
(Case Study: Student of Gadjah Mada University, Indonesia)

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Abstract

In order to alleviate the negative impacts of motorized vehicle use as well as create sustainable environment within campus area, it is important to encourage mode shifting among university students. Active transport modes such as walking, cycling, and using public transport can be considered as alternative modes. This study conducted to investigate students' travel behavior, particularly active commuting to the university. The potential for modal change were examined by using transtheoretical model of behavior change from Prochaska and DiClemente (1982). Furthermore, ANOVA test was employed to identify the perceptions between students across stages of change towards motivators and barriers for active commuting. Questionnaires were disseminated to active students and 417 valid responses were gathered. Results showed that there were some potential changing for students to use active modes. Moreover, there were also significant differences between students in perceiving motivators and barriers depending on their stages of change.

Keywords: active commuting, active transports, stages of change

INTRODUCTION

Nowadays, universities throughout the world have increasing their attention to encourage the use of more environmental friendly modes of transport on campus as a result of the increased awareness on climate change issues (Limanond, Butsingkorn, & Chermkhunthod 2011; Shannon, Corti, Pikora et al., 2006). University students have an irregular class schedule and various activities other than attending classes which then resulting on a complex yet unique travel behavior (Limanond et al., 2011). Therefore, a large university will have students with highly mixed daily activities and travel patterns which then results in a complicated transport situation (Huang, Xia, Zhang et al. 2012).

University students are a group that tends to use various types of travel mode, including large proportion of active transport use. Walking, cycling, and using public transport are considered as active forms of transport since these type of modes involve physical activity (Shannon et al., 2006). Implementing strategies that encourage university students to commute by using active modes will not only have environmental impacts but also health impacts as well as the potential in reducing depression and increasing academic performance (Shannon et al., 2006).Thus, active modes can provide an excellent form of transport for students.

As one of the largest university in Indonesia, the number of students in Gadjah Mada University (GMU) increase over time. The increasing number of students enrollment are associated with high number of motorized vehicles in campus area as students tend to choose motorized vehicles for their mobility. Based on Campus Development Master Plan (RIPK) document 2005-2015, GMU has a vision to create an educopolis campus, a conducive environment for learning within the developed context of multidiciplinary collaboration and responsive to ecological issues (RIPK, 2004). Therefore, based on Rector Decision, there would be an environmental regulation includingsomestrategies to control the used of motorized transports in campus area, particularly students' private vehicles. Students are expected to switch their current travel modes to other alternative modes. Active transport modes are considered as possible alternatives. Meanwhile, bringing about mode shifting is still challenging since there are still lack of supports and facilities on those aforementioned modes.

This paper aims to investigate GMU students' travel behavior, particularly active commuting travel to the university. The overall aim is achieved through a deeper understanding on the potential for modal change based on transtheoretical model (TTM) of behavior change from Prochaska and DiClemente (1982) as well as barriers and motivators towards active commute depending on students' stages of change. Identifying barriers and motivators will provide valuable insights regarding students' perceptions towards active transport modes. Moreover, this paper will also elaborate motivators and barriers that is important for students in general, regardless of the group segmentations.

THEORETICAL FRAMEWORK

Travel Behavior

In order to alleviate the impact of automobile used, it is important to develop various strategies which can effectively motivate people to voluntarily change their current travel behavior. Indeed, to achieve the behavior change goal, the necessity of understanding processes as well as the motivation factors behind behavioral change is pivotal.To predict behavior, it is usual to relate it with attitude and intention. However, attitude was found to be not accurate in predicting behavior (Wicker, 1969 cited inGärling, Gillholm, & Gärling, 1998) which then Fishbein and Ajzen (1975, cited in Gärling, Gillholm, & Gärling, 1998) discovered that intention can predicts behavior better than attitude. A modification in intention whether it becomes increase or decrease is assumed to be directly associated with the probability that individual will execute certain behavior (Bamberg, 2007).

Transtheoretical Model of Behavior Change

In 1982, Prochaska and DiClemente proposed a transtheoretical model of behavior change (TTM) which described stages model of behavior change.Although their finding was used for describing behavior change in health behavior, particularly smoking behavior, this model have been developed to further explain behavior change in active commuting behavior (Nkurunziza et al., 2012; Redding et al., 2014; Crawford, Mutrie, & Hanlon, 2001; Shannon et al., 2006).In this model, behavior change is viewed as progressing process through a series of five stages of change: pre-contemplation (no intention to

change), contemplation (growing intention), preparation (ready), action (change occured), and maintenance (change preservation).

This model consists of three key constructs: processes of change, decisional balance, and self-efficacy.Progression through the five stages is facilitated by two motivational constructs which are decisional balance and self-efficacy, and each stage will have their own appropriate processes of change to stimulate behavior change (Bamberg, 2007). Therefore, stages of change were found to be related to decisional balance, which referred to pros(motivators) and cons (barriers) towards behavior change, and self-efficacy, which referred to confidence level towards behavior change (Redding, et al., 2014). Individual in the early stages of change (pre-contemplation and contemplation) tend to value deterrents of behavioral change outweighing pros of behavioral change, whilst in the late stages of change (action and maintenance) the opposite conditions happened (Bamberg, 2007). In contrast, motivators will be assessed lower by individual who are in pre-contemplation stage rather than those who are in action or maintenance stages (Redding, et al., 2014). If these two conditions are happened, then the pros and cons of a problem behavior will cross over in either the contemplation or the preparation stages of change.

METHODOLOGY

Respondents

The respondents in this study were all active students of GMU. The number of students' population in GMU in 2012 was 51.796. Therefore, with confident level 95% (margin error 5% and precision level given 0.5), the number of minimum sample is 397 respondents. About 510 responses were received, but there are only 417 responses which are valid to be included in the further analysis.

Data Collection and Analysis

Quantitative method was chosen for the analysis and questionnaire became the main tool for collecting primary data which disseminated to active students in GMU through social media and electronic mail. The analysis was executed by using *one-way* ANOVA test which can be used to identify the different perceptions of motivators and barriers toward active commuting behavior depending on students' stages of change.

Questionnaire

The questionnaire consisted of four sections. In the first section, questions related with socio-demographic information were asked. In order to understand the possible mode based on students' residential distance, the region was divided into three zones (Zone 1: < 1 km from GMU, Zone 2: 1-5 km from GMU, and Zone 3: >5 km from GMU) that represented walkable and cyclable catchments. Residential distance below one kilometer away from campus was chosen to represent a feasible walking distance which also can be reached by bike. While residential distance within one to five kilometers away from campus represents a feasible cycling distance. Finally, distance of more than five kilometers away from campus will have public transport as travel choice to actively commute.

In the second section, the participants revealed their current stages of change and self-efficacy for active commuting to the university. Then, in the further section, respondents were asked to measure several motivators and barriers toward active commuting behavior for revealing the importance level of those items in encouraging and/or impeding them to use active transport modes in their trips to university.

Table 1 Statements for stages of change in active commuting behavior

Corresponding stages of change	Statement shown to respondents
Pre-contemplation	I do not regularly walk/cycle/use public transport and do not intend to do so in the next 6 months
Contemplation	I do not regularly walk/cycle/use public transport but am thinking about starting to do so in the next 6 months
Preparation	I sometimes walk/cycle/use public transport but not more than once per week
Action	I regularly walk/cycle/use public transport but have only begun to do so in the last 6 months
Maintenance	I regularly walk/cycle/use public transport and have been doing so regularly for more than 6 months

Students were asked to state their current stages of change for active commuting behavior based onattitudinal statements as shown in Table 1. Then, for defining self-efficacy information, each respondent also rated their level of confidence that they could/would actively commute in each specific mode (walking, cycling, and using public transport) on a five-point Likert scale which is ranging from “not at all confident (1)” to “very confident (5)”. Furthermore, motivator and barrier items were also rated by students using a five pointLikert scale which is ranging from “not at all important (1)” to “very important (5)”.

RESULTS AND DISCUSSIONS

Students’ Modal Split

Most of students reported motorcycle (71%) as their mode choice for university travel. While car only accounted for about 7% of students’ travel mode. Accordingly, there were almost 80% of the students using motorized vehicles for the university trips. In contrast, there were only few students who reported active transport as their travel mode. Walking, bicycle, and public transport were reported to be used by 13%, 8%, and 1% of the students respectively.

Result showed that active transport use was quite high for those living in Zone 1 and Zone 2, most likely because this zone is feasible to be reached by this type of travel modes. However, the prevalence of active commuting for students living in Zone 1 overall was higher compared to those living in Zone 2 because of the higher proportion of students living in Zone 1 who reported walking (35%) and cycling (10%) to campus. Meanwhile, active transport use was very low in Zone 3 with only less than 1% of students using public transport and bicycle, and none of them walking to campus. In addition, public transport use was not popular among students within all zones. It is only reported less than 2% of students in allzones.

Potential for Change

The potential for a change, particularly mode shifting from motorized vehicle to active transport modes, can be measured through stages of change towards active commuting behavior and self-efficacy which represent individual confidence level for behavior change. Respondents were grouped into five different stages of change: pre-contemplation (41.5%); contemplation (24.9%); preparation (11.5%); action (6.2%); maintenance (15.8%).

Table 2 Result for students' stages of change based on residential zones (%)

	Zone 1 <1 km n = 120	**Zone 2 1-5 km n = 189**	**Zone 3 >5 km n = 108**
Pre-contemplation	20,0	40,7	66,7
Contemplation	23,3	24,9	26,9
Preparation	10,0	16,4	4,6
Action	12,5	4,8	1,9
Maintenance	34,2	13,2	0,0

In order to reveal student groups who are able to actively commute and who are not, distance groups are employed with an assumption that the origin of the trips are always begin from residential place. Table 2shows that most students reported living within one to five kilometers (45.32%) away from campus which also corresponds with the student proportion who have a potential to cycling. While the rest of them reported living below 1 kilometer (28.78%) and more than 5 kilometers (25.90%) away from campus.

Moreover, alarge proportion of students (66.7%) in Zone 3 are currently in pre-contemplation stage thus the majority of students who live in this zone does not have any intention to change into active transport modes. As the residential distances to the university decline, the proportion of students who posited themselves in the pre-contemplation stage were decreased as well (20.0% in Zone 1 and 40.7% in Zone 2). In the other hand, there is similar proportion between contemplators within all zones (23.3% in Zone 1, 24.9% in Zone 2, and 26.9% in Zone 3). This indicates thatthere is potential for a modal shift to active modes across all three zones. Furthermore, there is a sizeable proportion of students (34.2%) in Zone 1 who were already in the maintenance stage and 10% of them reported themselves in the action stage.

Table 3 Result for self-efficacy in active commuting based on residential zones (%)

	Zone 1 <1 km			**Zone 2 1-5 km**			**Zone 3 >5 km**		
	Walking	Cycling	PT	Walking	Cycling	PT	Walking	Cycling	PT
Not confident at all	4,2	2,5	42,5	27,0	13,2	43,4	71,3	30,6	22,2
Not confident	20,8	22,5	30,0	35,4	20,6	30,2	16,7	35,2	42,6
Neither nor	30,0	34,2	15,0	21,7	23,8	16,4	8,3	20,4	19,4
Quite confident	21,7	23,3	10,0	11,6	31,7	7,9	3,7	13,9	14,8
Very confident	23,3	17,5	2,5	4,2	10,6	2,1	0,0	0,0	0,9
% current condition	35,0	10,0	1,7	6,3	10,1	1,6	0,0	0,9	0,9

Self-efficacy items can be also used to gauge potential for change among students. If students are confident that they could perform a certain activity, they would more likely to make the change, given the appropriate incentives and supports. As presented in Table 3, there are 35% of students in Zone 1 who currently walking to the university. However, 45% of them are confident for walking regularly and continuing to do so. This demonstrates that an additional 10% of students living in Zone 1 could be encouraged to walk to the university. In the other hand, eventhough only 10% of students in this zone currently take bicycle as their travel mode, 40.8% are confident that they could execute cycling as their regular basis. Therefore, there is a possibility that students who cycling to university in this zone will increase 30% if being encouraged to do so.

While in Zone 2, only 10% of students are currently cycling to the university. However, there are a sizeable proportion of students (42.3%) who were confident to cycle to the university and continue to do so. Therefore, students who cycling to the university in this zone will probably increase by 30% in the future. Meanwhile, public transport appears not popular among students which can be seen that there are only less than 2% of students who currently using this modes to travel to the university among all three zones. Moreover, only small number of studentswas confident to use public transport on regular basis for their university travel (12.2% for overall zones).

Perceived Motivators and Barriers toward Active Commuting

The results from one-way ANOVA test showed that perceived motivators between stages of change levels were significantly different in most instanceswhich found for 9 out of the 11 motivators as a function of stages of change. The most significant stage of change differences related to the perceived motivators were occured on parking restrictions item ($F(4, 412) = 8.157$, $p < 0.001$). In the other hand, the lowest significant magnitude differences were occured on paid parking item ($F(4, 412) = 2.453$, $p < 0.05$). Meanwhile, there were no significant differences on safe parking area and car free day items which indicated that the perception of students in all stages of change towards these two item were similar.

The differences might appear due to the low scores given to items by pre-contemplators. As shown in the Table 4, contemplators rated higher importance perceptions in all motivator items than did those in the pre-contemplation stage. This suggests that contemplators may already be aware of the benefits of using active modes, and thus promoting the benefits may have little impact. Interestingly, in several motivator items, actors attached more importance, particularly environmental awareness, health, saving expenses, and bike facilities, than do those in the maintenance stage. While the rest items were attached with higher important perceptions by maintainers.

From Table 4,it can be also seen that pre-contemplators, contemplators, prepares, and maintainers reported protected biking and walking lanes from weather condition, safe parking area, and environmental awareness as the three biggest motivators associated with active commuting to the university. In the other hand, actors' perceptions differed slightly. Actors reported environmental awareness, health, and saving expenses as the biggest

motivators to actively commute. However, there was an interesting result found in this study in which students across all stages of change had an agreement that parking restrictions and paid parking were rated with lowest importance in motivating them to actively commute, respectively.

Table 4 One-way ANOVA results for perceptions of motivators between students' stages of change

Motivators	PC		C		P		A		M		F	*p*
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Lanes are protected from weather	4.50	0.74	4.61	0.72	4.67	0.69	4.42	0.81	4.82	0.46	4.524[a]*	< 0.05
Safe parking area	4.50	0.74	4.55	0.71	4.67	0.69	4.50	0.81	4.71	0.52	1.790[a]	0.136
Environmental awareness	4.29	0.83	4.58	0.70	4.56	0.74	4.77	0.51	4.52	0.83	4.880[a]**	< 0.001
Health	4.25	0.83	4.44	0.87	4.60	0.68	4.62	0.64	4.53	0.66	3.600[a]*	< 0.05
Saving expenses	4.18	0.91	4.25	1.01	4.50	0.77	4.62	0.70	4.55	0.68	4.433[a]*	< 0.05
Presence other active commuters	4.03	0.91	4.32	0.71	4.17	0.88	4.42	0.70	4.42	0.79	3.900*	< 0.05
Bike shelters and campus bike	3.94	1.00	4.17	1.04	4.31	0.93	4.38	0.98	4.35	0.81	3.457*	< 0.05
Car free day	3.90	1.03	4.03	1.04	4.08	0.94	4.19	1.06	4.21	0.90	1.504	0.200
Motorized vehicle free area	3.43	1.16	3.61	1.22	3.77	1.02	3.73	1.43	4.11	1.01	5.083[a]**	< 0.001
Parking restrictions	2.23	1.18	2.73	1.28	2.60	1.25	3.08	1.32	3.11	1.18	8.157**	< 0.001
Paid parking	2.01	1.24	2.26	1.29	2.19	1.27	2.42	1.60	2.56	1.31	2.453*	< 0.05

Notes: PC = Pre-contemplation, C = Contemplators, P = Preparation, A = Action, M = Maintenance, F = ANOVA score, p = Significance level, * ≤ 0.05, ** ≤ 0.001, [a] = Levenes' test for homogeneity of variance has been violated (p = ≤ 0.05) so the Welch test (adjusted F) has been used instead

Meanwhile, for barrier items, having high mobilities and activities was reported as the biggest barrier among students in all five different stages of change which hindering them to actively commute to the university. However, there was no statistically significant differences across the five stages for this item(p = 0.096). The most significant differences was happened in the availability of motorized vehicle access item ($F(4, 412) = 7.424$, $p < 0.001$). Furthermore, travel distance and longer travel time items were also reported to have significant differences.

Table 5 demonstrates that compared to those in the action and maintenance stages, barrier items were perceived higher for those in the lower stages. It is clear that those in the action and maintenance stages attached less importance to barriers generally. This results reveals that although there was some agreement between each stage about which barriers were the biggest hinder, significant stage differences in the perceived strenght of these barriers were found. Perceptions of barriers incrementally decreased from pre-contemplation through to maintenance stage. However, interestingly this trend did not applied for social status item in which actors and maintainers perceived greater barriers compared with pre-contemplators, contemplators, and preparers.

Table 5 One-way ANOVA results for perceptions of barriers between students' stages of change

Barriers	PC		C		P		A		M		F	*p*
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
High mobilities and activities	4.47	0.76	4.41	0.76	4.19	0.84	4.08	1.13	4.26	0.87	2.022[a]	0.096
Travel distance	4.43	0.92	4.09	1.06	4.06	1.00	3.69	1.22	3.98	1.06	5.240**	< 0.001
Longer travel time	4.28	0.91	4.10	0.94	3.88	1.02	3.88	0.95	3.74	0.93	5.028**	< 0.001
Infrequent PT services	4.25	0.86	4.19	0.93	3.94	0.98	3.58	0.95	3.94	0.91	4.614**	< 0.001
Covered area of PT services	4.25	0.82	4.15	0.91	3.90	1.08	3.69	0.84	4.08	0.83	3.400*	< 0.05
MT vehicle access	3.91	0.98	3.63	1.03	3.69	1.13	3.35	1.02	3.15	0.98	7.424**	< 0.001
Clothes	3.84	0.99	3.75	1.09	3.48	1.19	3.54	1.21	3.30	1.08	3.747*	< 0.05
Social status	2.66	1.35	2.70	1.29	2.54	1.35	3.31	1.35	3.15	1.29	3.121	0.015

Notes: PC = Pre-contemplation, C = Contemplators, P = Preparation, A = Action, M = Maintenance, F = ANOVA score, p = Significance level, * ≤ 0.05, ** ≤ 0.001, [a] = Levenes' test for homogeneity of variance has been violated (p = ≤ 0.05) so the Welch test (adjusted F) has been used instead

The barrier items were also analyzed with the residential distance zone categories. From the Table 6, it can be seen that there were significant differences for several items across three zones, including travel distance and travel time. Moreover, the biggest significant differences were also occured in these two items (travel distance ($F(4, 414) = 14.085$, $p < 0.001$); travel time ($F(4, 414) = 8.939$, $p < 0.001$)). Predictably, those within closer residential distance from the university rated these two items lower than those living far from university. This is most probably influenced by the longer distance and time involved for those in Zone 3 in active commuting activities. Furthermore, barrier items associated with public transport services, the coverage area and frequent service, were also reported with high importance for impeding students to actively commute with statistically significant differences between those in Zone 1 and 3. This reveals that students in Zone 1 and 2 have slight similarity in perceiving barriers for active commuting.

Table 6 One-way ANOVA results for perceptions of barriers between students' residential zones

Barriers	Zone 1 (<1 km)		Zone 2 (1-5 km)		Zone 3 (>5 km)		Total		F	*p*
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
High mobilities and activities	4.34	0.82	4.37	0.83	4.39	0.81	4.36	0.82	0.094	0.910
Travel distance	3.88	1.20	4.17	0.97	4.56	0.80	4.19	1.03	14.085[a]**	< 0.001
Covered area of PT services	3.98	0.98	4.12	0.84	4.30	0.85	4.12	0.89	3.573*	< 0.05
Infrequent PT services	3.94	0.97	4.14	0.90	4.25	0.87	4.11	0.92	3.394*	< 0.05
Longer travel time	3.95	0.92	3.97	1.01	4.41	0.81	4.08	0.96	8.939**	< 0.001
Clothes	3.53	1.08	3.74	1.11	3.72	1.00	3.67	1.08	1.621	0.199

MT vehicle access	3.44	1.08	3.69	1.02	3.83	1.00	3.66	1.04	4.286*	< 0.05
Social status	3.12	1.31	2.80	1.36	2.35	1.24	2.78	1.34	9.704**	< 0.001

Notes: Z 1 = Zone 1, Z 2 = Zone 2, Z 3 = Zone 3, F = ANOVA score, *p* = Significance level, * ≤ 0.05, ** ≤ 0.001, [a] = Levenes' test for homogeneity of variance has been violated (*p*= ≤ 0.05) so the Welch test (adjusted F) has been used instead

CONCLUSIONS

Findings revealed that majority of students are using motorized transport as their travel mode to the university (78%) while only the rest of them accounts for active transport modes. However, there are potential to increase the level of active commuting among students. Although majority of students are in the pre-contemplation stage where there are no intention to use active modes to the university in near future, but results show a sizeable proportion of students who reported high confidence to actively commute, particularly walking and cycling.

Furthermore, results showed that students in all stages of change were more motivated to actively commute towards cycling facility improvements in which there are conditions where the university provides protected pedestrian and cyclists lanes from weather condition, safe bike parking area, and more campus bike and its shelters. In the other hand, conditions where parking restrictions and paid parking are employed in the university, will not motivated students to actively commute. Regarding factors which impeded students to actively commute, students in all stages of change reported having high mobilities and activities to be the biggest barrier. Moreover, travel distance and time were also appeared as important barriers for students even for those who live within close distance.

Regarding the perception towards motivators and barriers to actively commute, results indicated that there were significant differences between students across stages of change level in perceiving the importance of each items in motivating and hindering them to actively commute. The differences particularly appeared between those in the early stages of change (pre-contemplation, contemplation, and preparation) and those in the late stages of change (action and maintenance). The perceptions of motivators incrementally increased from pre-contemplation stage through to maintenance stage. In the other hand, perceptions of barriers incrementally decreased from pre-contemplation through maintenance stage.

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