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Effect of habit and car access on student behavior using cars for traveling to campus

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Abstract

This study reports an investigation of psychological factors influencing this behavior from the perspective of the Theory of Planned Behavior and Norm Activation Model, with the addition of habit and car access. Students from three different university campuses in Surabaya, Indonesia, (n = 312) completed a survey on their car commuting behavior. Results indicated that habit and ascription of responsibility were the strongest factors that influence personal norm, perceived behavioral control and personal norm were the strongest factors that influence behavioral intention, and habit was the strongest factors that influence actual behavior, while car access only significantly influence habit, rather than both perceived behavioral control and actual behavior. Habit, awareness of consequences, and ascription of responsibility explain 54% variance of personal norm. Attitude, subjective norm, perceived behavioral control, and personal norm explain 50% variance of the behavioral intention. In turn, behavioral intention, habit, and car access explains 55% of the variance of the actual car use. Implications of these findings are that in order to alter the use of car, university should implement both structural and psychological interventions. Effective interventions should be designed to raise students' awareness of consequences and sense of responsibility of negative aspects of car use.

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1. Introductions

Along with the increasing number of students' using cars for traveling to campus, potentially raise various problems, such as the loss of open green space because of the provision of parking facilities, as well as the impact of health on the campus community. Campus also gives effect to the community living around the campus, among others, traffic congestion and social conflict with residents. Facing that transportation problem, the unbalance between transportation demand and supply, campus generally take the conventional approach to overcome by increasing the supply (e.g., parking space, widening road), or let it and hope there will be an initiative from other parties to do something to balance those conditions [1,2]. But the effort to overcome the problems are often hampered by various things , namely: limited provision of land for parking space, the high cost of parking facilities development, the complained from resident around campus , and desire to keep the air quality and open green space on campus.

Therefore, the active role of campus is very important to achieve sustainable campus transportation, to keep the quality of life of the campus community, as well people living around it, and to reduce the environmental impact because of the use of motor vehicles [1]. Campus is the right environment to experiment and to implement transport policy changes, as well as having authority with respect to the management of transportation facilities in the campus [3]. In addition, travel pattern and an awareness of the impact of transport on the environment experienced by students during their study will affect their travel behavior in the future [2].

An effective solution to address the problems related to the use of cars requires a reduction in car traffic volume based on changes in car user behavior [4]. Because the journey is an expressive activity, there is an instrumental and affective component in the behavior and travel options [5,6]. Thus, policy to change individual behavior on the use of cars would be more effective when the intervention or action is directed to motivational use of cars [7,8,9].

Currently, utility theory is the most common model used to study how people make choices related to the travel activities, travel destinations, and mode of transportation. Various studies have been conducted based on random utility theory relating to the selection of transportation mode; in general, attention is focused on the evaluation of attributes associated with the options available [10]. Random utility theory assumes that individual choice related to a particular transportation mode is based on the individual socio-economic characteristics and attributes that describe the available options.

Research in developing countries prove that some social-psychological variables, factors related to attitudes, and affective evaluations, can contribute significantly to the utility model, and help to increase compliance on the utility model [11]. Therefore, it is important to include the attitude and personality traits through latent variables approach, since there is interaction between the beliefs, values, emotions, attitudes, and personality traits when individuals choose an alternative and to integrate attitudes and personality traits with the estimation of mode choice model in order to understand the influence of the variables underlying mode choice [12].

Behavior model is a method to determine psychological factors that mostly affect students' behavior in using cars for traveling to campus. Such information is a useful input in designing various campus transport policies. There are different models of behavior that can be used to study the psychological factors that affect the individual mode choice, among others, the Theory of Planned Behavior (TPB) and Norm Activation Model (NAM) [13].

The Theory of Planned Behavior (TPB) is the development of the Theory of Reasoned Action (TRA) [14]. TPB is the most popular conceptual frame at this time to explain the determinants of specific behavior. TPB has been used in a variety of research to provide a better understanding of the various behavior, not only in the field of social psychology but also in other fields [15]. TPB has also been used to study the behavior of mode choice to travel among the students [9,16,17].

In contrast to TPB, which refers to a non-altruistic behavior (the attitude of helping others insincerely), Norm Activation Theory (NAT) or Norm Activation Model (NAM) is proposed to explain the psychological process related to altruistic behavior (the attitude of helping other people sincerely). NAM was initially developed to describe the behavior of the pro-social behavior. Consequently, researchers use NAM in the conceptualization of behavior to reduce car use as a behavior that is driven mainly by the motivation of pro-social behavior. That view is reflected in the assumption that normative self-expectations or personal norm (PN) is the most important determinant of mode choice [18]. When individuals value the well-being of other individual and believe that his behavior will give other individuals the consequences, or the awareness of the consequences (AC), and feel a personal responsibility due to

the consequences, or the ascription of responsibility (AR), such individual will feel a moral obligation to protect the well-being of others. AC and AR are important precondition cognitive for the establishment of PN.

The predictive power of the TPB will improves if a measure of mode choice habits is included as an additional predictor of travel mode choice [19], and integrated habits into the NAM, significantly increased the explained variation in car use behavior [20]. Therefore, added habits into the TPB and NAM will improve both the explained behavioral variation and a moderating effect of habits on the relation between personal norms, intention, and behavior [21]. Habits are relatively stable behavioral patterns, which have been reinforced in the past [22].Habit is important for predicting car choice behavior on the way to the campus, because students normally travel to the campus around the same time every day with the same route and the same intention (e.g., attending classes) [9]. A habitual conduct not necessarily preceded by a behavioral intention; a strong habit might help to predict actual behavior more accurately than a behavior intention [11]. The more often behavioral patterns is successfully performed in stable circumstances, the more important habits become as a predictor of behavior, and the less important become intentions [21].

So far, however, there has been little discussion about the integration of TPB, NAM, habit and car access on student behavior model using cars for traveling to campus [9,16]. Therefore, to understand the nature of the relationships between the various psychological factors that affect the behavior of students' car use for university routes, the main issues that will be explored through this research is to determine these relationships based on the integration of TPB and NAM. The psychological factors analyzed in this study are: Attitude (ATT), Subjective norms (SN), Perceived behavioral control (PBC), Awareness of consequences (AC), Ascription of responsibility (AR), Personal norm (PN), Habit (H), and Car access (CA).

It is expected that the research findings can be beneficial for designing campus transportation policies to reduce students' car use for university routes. Findings on the psychological factors that mostly affect students' behavior using a car to campus can provide recommendation in considering the kind of psychological interventions, in addition to the structural interventions, which needs to be applied by the campus to affect the behavior of students' car use for university routes.

2. Methods

The research used a convenience sample of 312 student university-based car commuters from three private universities in Surabaya, Indonesia: (1) Petra Christian University, (2) Surabaya University, and (3) Widya Mandala Catholic University [23]. The study utilized a self-report paper and pencil questionnaire. Two or more indicators, with exception for car access and actual behavior (Table 1), measured all latent variables of the model. For AC and AR, three indicators were used; while for PBC, two indicators were used.

Table 1. Indicators Used for the Latent Variables

Latent Variable	Indicator
Attitude (4 items; Cronbach's α = 0.81; Construct Reliability (CR) = 0.878; Variance Extracted (VE) = 0.480)	ATTAS1: Driving a car means freedom to me
	ATTAS2:I love riding my car
	ATTAS3:I like driving a car because I can decide whom to drive with (privacy)
	ATTAS5: Riding my car is relaxing
	When you use the car for university routes next time, this will be
	… flexible (ATTIN1)
	… convenience (ATTIN2)
	… comfortable (ATTIN3)
	… safe and secure (ATTIN4)
Subjective Norm (8 items; Cronbach's α = 0.88; CR = 0.854; VE = 0.455)	Do you think that ... believe that a car is a necessity in daily life?
	… your parents … (BoNO1)
	… your brother/sister … (BoNO2)
	… your boy/girlfriend/best friend … (BoNO3)

Latent Variable	Indicator
	… your friend … (BoNO4)
	How strong would … support you if you use the car for university routes next time?
	… your parents … (SN1)
	… your brother/sister … (SN2)
	… your boy/girlfriend/best friend … (SN3)
	… your friend … (SN4)
Perceived Behavioural Control (2 items; Cronbach's α = 0.77; CR = 0.789; VE = 0.658)	I am able to use forms of transport other than the car to get to university (PBC2)
	It would be easy for me to reduce my car use when getting to university (PBC3)
Awareness of Consequences (3 items; Cronbach's α = 0.69; CR = 0.767; VE = 0.525)	Constructing new roads and parking places for the increasing number of car threatens the last intact biosphere in this country (AC1)
	Avoiding using the car to commute to and from campus will help to solve wider environmental problems (air pollution, noise) (AC2)
	I can help to solve my campus's transport problems by avoiding car use (AC4)
Ascription of Responsibility (3 items; Cronbach's α = 0.76; CR = 0.768; VE = 0.525)	It is not only the state and the industry who are responsible for reducing the traffic related environmental pollution, but me too, for example with my decision to use car for university routes (AR1)
	I feel personally responsible for the problems resulting from car use (AR2)
	I contribute to environmental problems if I use car for university routes (AR3)
Personal Norm (4 items; Cronbach's α = 0.60; CR = 0.700; VE = 0.373)	I am trying to use the car less (PN5)
	Reducing my car use would make me feel good (PN7)
	For the sake of environment, car users should pay higher taxes (PN8)
	*Due to my values/principles, I feel obligated to use the car for university routes (PN13)
Car Access (1 item)**	How often do you have access to a car for traveling to campus (CA)
Habit (7 items; Cronbach's α = 0.91; CR = 0.910; VE = 0.595)	Using Cars for Traveling to Campus is something
	… I do frequently (H1)
	… that makes me feel weird if I do not do it (H2)
	… I have no need to think about doing (H3)
	… that belongs to my (daily, weekly, monthly) routine (H4)
	… I would find hard not to do (H5)
	… that's typically "me" (H6)
	… I have been doing for a long time (H7)
Behavioural intention (4 items; Cronbach's α = 0.63; CR = 0.743; VE = 0.420)	*I intend to reduce car use for university routes during the next semester (BI1)
	How often will you use the car for university routes during the next semester (BI2)
	*Do you do various things to refrain from car use for university routes (BI3)
	*Have you ever had a commitment to reduce the use of car for university routes (BI4)
Actual Behavior (1 item)**	How often did you travel by car for university routes in the previous semester (AB)

All items used scales with response options disagree strongly, disagree, neither agree nor disagree, agree, agree strongly. Disagree strongly was coded as 1 and agree strongly as 5.

Indicator marked * were reverse coded for analysis. Indicator marked ** were used scales with response options never, rare, occasionally, often, always. Never was coded as 1 and always as 5.

Before the data were analyzed, the data was filtered to check in advance to evaluate for the existence of outlier in the data that would be analyzed. This research was conducted in two stages of screening data, i.e. univariate outlier

and multivariate outlier. Univariate outlier test begins by calculating a Z-score response of each question in questionnaire that will be used in the structural equation model analysis using Statistical Package for the Social Science (SPSS)

Based on an examination of the results of univariate outlier test, from 380 data there were 41 data that has a range of Z-score outside the required range of Z-score <-3.00 or Z-score >3.00 [24]. Multivariate outlier test is done by computing the Mahalanobis D^2 [24]. From 339 data that have gone through stages of univariate outlier test, there were 27 data with a probability value of Mahalanobis $D^2 \leq 0.001$. Thus, the number of test data left after performing multivariate outlier test is 312 data.

3. Results

Estimation of model was determined using Analysis of Moment Structure (AMOS) [25] and the result met the statistical portion of the suitability of the model (Table 2). There are four invalid constructs with Variance Extracted (VE) <0.50, i.e. ATT (0.480), SN (0.455), PN (0.373), and BI (0.420), but the all of invalid constructs are qualified CR≥0.70 (Table 2). The Model is considered optimum because Modification Indices (MI) did not propose any addition of error covariance that can increase model goodness of fit, and increase validity and reliability model construct significantly.

Table 2. Model Goodness of Fit

Goodness of Fit Indicators	Acceptable Threshold Levels	Estimate	Note
Absolute-Fit Measures			
χ^2 (Chi-Square)	expected low	1.551,06	-
Significance of Probability	≥0,05	0,00	insignificant
Degree of Freedom		724	-
CMIN/df	≤2,00	2,14	insignificant
GFI	≥0,90 (good fit), 0,80 ≤ GFI < 0,90 (marginal fit)	0,80	insignificant
RMR	≤0,05 (good fit)	0,08	insignificant
RMSEA	≤0,08 (good fit), < 0,05 (close fit)	0,06	good fit
Incremental-Fit Measures			
TLI		0,86	marginal fit
NFI		0,79	insignificant
AGFI	≥0,90 (good fit),	0,76	insignificant
RFI	0,80 ≤ GFI < 0,90 (marginal fit)	0,77	insignificant
IFI		0,88	marginal fit
CFI		0,88	marginal fit

Fig. 1 shows the structural model. All Standard Loading Factor (SLF) are significant ($p \leq .05$), except for the effect of CA to AB ($p = .053$), SN to BI ($p = .062$), CA to PBC ($p = .071$), ATT to BI ($p = .659$), and H to AR ($p = .856$). Construct CA gives significant influence to H, construct H gives significant positive influence to ATT, SN, PBC, AC, PN, and AB, construct AR and AC gives significant positive influence to PN, construct PBC gives significant positive influence to BI, construct PN gives significant negative influence to BI, and construct BI gives significant positive influence to AB.

Increasing of students' car access (CA) will increase students' habit using car (H). Increasing of H will increase student's attitude (ATT), subjective norm (SN), and perceived behavior control (PBC) related to using cars for traveling to campus and students' actual behavior (AB) using cars for traveling to campus. However, increasing of H will also decrease student's Awareness of Consequences (AC) and personal norm (PN) related to using cars for traveling to campus. Increasing of PBC will increase students' behavioral intention (BI) using car for traveling to campus, while increasing of PN will decrease BI. Thereafter, increasing of students' behavioral intention (BI) using

car for traveling to campus will increase students' actual behavior (AB) using cars for traveling to campus. H, AC, and AR explained about 54% variance of PN whereas construct ATT, SN, PBC, and PN can explain about 50% variance of BI, and about 55% variance of AB explained by H, BI, and CA (Fig. 1). Construct PBC and PN are mostly affected by construct H, while construct BI are significantly affected either by construct PBC and construct PN, and construct AB are significantly affected either by construct BI and construct H.

4. Discussion

The results indicate that students' behavior intention to use cars was strongly predicted by their perceived behavioral control and personal norm related to using cars for traveling to campus. While students' personal norm, strongly predicted by their sense of responsibility (ascription of responsibility, AR) and habit (H) to using cars rather than by their awareness of the consequences (AC) related to using cars for traveling to campus..

Behavior model is a method to determine the psychological factors that mostly affect students' behavior using cars for traveling to campus. Such information is a useful input in designing various campus transport policies. Based on the structural model of TPB+NAM+H+CA, PBC is influenced more by H than by CA, and PN is influenced more by H and AR, than by AC. The combination of positive influence of TPB construct (PBC) and negative influence of NAM construct (PN) led to increasing or decreasing of students' behavioral intention (BI); furthermore, positive influence of BI and H will increase students' actual behavior (AB) using cars for traveling to campus.
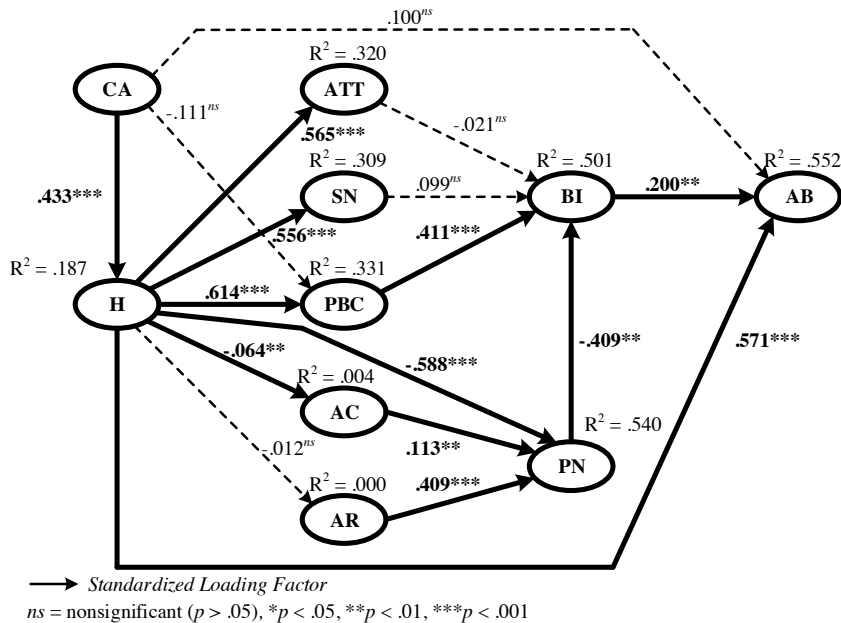

Fig. 1. Structural Model of TPB+NAM+H+CA

Based on the relationships between psychological factors in model TPB+NAM+H+CA, campus needs to devise strategies of intervention which is a combination of the structural interventions (hard transport measure) and the psychological intervention (soft transport measure), to affect students' motivation to reduce the use of cars. Motivation to reduce car use is influenced by individual and contextual factors. Such interventions should be directed primarily to raise students' awareness consequences and to enhance student sense of responsibility (ascription of responsibility) with regard to the negative impact of using car for traveling to campus.

Structural intervention can be either facility incentives or disincentives (such as bicycle facilities, preferential parking space for car-share, restricted parking location inside campus area, student dormitories,). Other structural

interventions can be either financial incentives or disincentives (e.g., ease of bicycle ownership installment, the chance to try a vanpool service free of charge, guaranteed ride home for car-share and vanpool participant, and the enforcement of the more expensive parking fee rates for those who drive alone on the contrary free parking for car-share and vanpool participant). Meanwhile, the psychological intervention can be in the form of educational programs and campaigns (e.g., travel awareness campaigns the negative impact of using car and positive impact of using others mode choice for traveling to campus). Another form of psychological interventions is such as personalized travel planning, public transport and car-sharing marketing information schemes.

Further research needs to be done by adding the various factors that influence the behavior of the model allegedly, such as car ownership, and distance of residence to get a better behavioral model that can explain students' behavior intention and actual behavior using car for traveling to campus. It is also recommended to perform further research to analyze the psychological factors that mostly affect the actual behavior and behavior intention of students' car use for university routes, due to the implementation of structural interventions and psychological intervention during a specific time period, for example the ride share program. Thus, the sensitivity of each psychological factor in behavioral models can be evaluated, as well as the effectiveness and feasibility of implementing these interventions to reduce students' car use for traveling to campus.

5. Conclusions

Student behavior model using cars for traveling to campus is an important contemporary issue, influencing such factors as traffic congestion and social conflict with residents. This study explored the relationship between the various psychological factors that affect the behavior of students' car use for university routes based on integration of Theory of Planned Behavior (TPB), Norm Activation Model (NAM), habit, and car access. Overall, the results highlight that students' behavior intention using cars for traveling to campus is influenced both by the perceived behavioral control and by personal norm; students' actual behavior using cars for traveling to campus is influenced both by students' behavior intention using cars for traveling to campus and by students' habit of using cars. The combination of positive influence of TPB construct (perceived behavioral control) and negative influence of NAM construct (personal norm) led to increasing or decreasing of students' behavioral intention; furthermore, positive influence of students' habit of using car and students' behavioral intention will increase students' actual behavior using cars for traveling to campus.

The results of the research have implications for university policy aimed at reducing the number of students using cars for traveling to campus. It is suggested that the main strategy should be to focus on raising students' personal norm, specifically attempting to raise students' awareness of consequences and sense of responsibility of negative aspects of car use, through implementation both structural and psychological interventions.

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