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The effect of students' car access and car use habits on student behavior to reduce using cars for traveling to campus

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Abstract

This study reports an investigation of psychological factors influencing student behavior to reduce using cars for traveling to campus from the perspective of the Norm Activation Model, with the addition of students' car access, and car use habits for traveling to campus. Students from three different university campuses completed a survey on their car commuting behavior. Results indicated that a car use habit, awareness of consequences, and ascription of responsibility explain 63% variance of personal norm. Personal norms explain 47% variance of the behavioral intention. In turn, behavioral intention, car use habit, and car access explains 54% of the variance of actual car use. A car use habit and ascription of responsibility were the strongest factors that influence personal norms, and car use habit was the strongest factors that influence actual car use behavior, while car access significantly influence car use habit and actual car use behavior. Implications of these findings are that in order to alter the use of car, universities should implement both structural and psychological intervention. To be effective interventions should be design to removing opportunities for enactment of car use habit, also to enhance the sense of responsibility towards the negative impact of car use.

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Keywords: Students' car use; norm activation model; car access; car use habit.

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1. Introduction

Private cars, although they provide many societal functions as well, also contribute to various problems, such as traffic congestion and environmental pollution. About 70% of urban air pollution was generated from vehicle exhausts [1]. Despite attempts at diminishing the environmental impact of cars use by means of technological innovations (e.g. fuel cell technology, hybrid fuel systems, and more efficient engines), factors affecting car use behavior and intentions to reduce it are crucial to examine when designing travel demand management policies to reduce car use. Because various trends tend to invalidate positive effects of technological innovations in cars, such as increased car ownership, and increased frequency of car use [2].

In 2012, there were 73,035 university students in Surabaya [3], and some of them were private universities, were the intensive use of private cars was usually high, but had limited resources to provide parking facilities, such as Petra Christian University [4]. Therefore, private universities have to decide between providing parking facilities or preserving open green space to diminish the impact of air pollution to the health of the campus community, also to avoid traffic congestion and social conflict with local residents.

Campus has an opportunity and important active role to achieve sustainable campus transportation, to reduce the environmental impact because of the use of motor vehicles, and to keep the quality of life of the campus community, as well people living around it [5]. Campus is the appropriate location to implement and to observe transport policy changes, as well as having authority with respect to the management of transportation facilities inside the campus [6]. In addition, encouraging sustainable travel behaviors at campus are an essential concern. At least for promoting sustainability, role models for society, deepening the understanding of sustainability, and increasing campus community health through sustainable mode choices [7].

An effective solution to address the issues related to car usage requires a reduction in car traffic volume based on changes in car use behavior [8]. Because traveling is an expressive activity, there are instrumental and affective elements in the behavior and travel options [9, 10]. Hence, a policy to change individual car use behavior would be more effective when the measure is directed to motivational factors in car use [11, 12, and 13].

Currently, random utility theory is the most common model used to study how people make choices related to selection of transportation mode; in general, attention is focused on the evaluation of attributes associated with the options available [14]. Research in developing countries demonstrates that some social-psychological variables can contribute significantly to the utility model, and increased conformity in the utility model [15]. Therefore, it is important to add the attitude and identity traits through an inherent variables approach, as 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 evaluation of a mode choice model in order to recognize the effect of the variables' underlying mode choice [16].

A behavior model is an approach to determine the psychological factors that mostly affect students' behavior in using cars for university routes. Such information is a useful input in planning various campus transport policies. There are different models of behavior that can be used to review the psychological factors that affect the individual mode choice, among others, the Norm Activation Model (NAM) [17].

Norm Activation Theory (NAT) or the Norm Activation Model (NAM) is proposed to explain the psychological process related to the attitude of helping other people sincerely (altruistic behavior). NAM was initially developed to describe pro-social behavior. Therefore, researchers use NAM in the conceptualization of behavior to reducing car usage as a behavior that is driven mainly by the motivation of pro-social behavior. That view is reflected in the assumption that a personal norm (PN) is the most important determinant of mode choice [2].

A personal norm (PN) is an obligation felt by individuals to keep their personal behavior in line with a full and total comprehension of personal values that are considered important by these individuals. NAM assumes that the formation and activation of a personal norm is the result of interaction between a cognitive, emotional, and social factor. In NAM, PN is affected by ascription of responsibility (AR) and awareness of the consequences (AC). When individuals feel a personal responsibility because of the consequences (AR), such individuals will feel a moral obligation to protect the well-being of others, value the well-being of other individuals, and believe that their behavior will give other individuals the consequences (AC). Thus, AR and AC are important pre-condition cognitive for the establishment of PN.

Added habits into the NAM, significantly increased the explained variation in car use behavior [18], also improves both the explained behavioral variation and a moderating effect of habits on the connection between personal norms, behavioral intention, and actual behavior [19]. Habits are relatively stable behavioral patterns, which have been strengthened in the past [20]. Students' car use habits are essential for forecasting students' car use behavior for traveling to campus, because students regularly travel to the campus about the same time every day with the same route and the same intention [13]. Habits behavior not necessarily prefaced by a behavioral intention; a strong habit may be able to help to predict actual behavior more precisely than a behavioral intention [15]. Therefore, the more often behavioral patterns are successfully performed in stable conditions, the more crucial habits become a predictor of actual behavior, and the insignificant become behavior intentions as a predictor of actual behavior [19].

So far, however, there has been little discussion about the integration of NAM, students' car usage habits and students' car access on student behavior model to reduce using cars for traveling to campus [13, 21]. Therefore, to understand the nature of the relationships between the various psychological factors that affect the actual behavior of students' car use for university routes, the main issues that will be explored through this research are to determine these relationships based on the integration of the Norm Activation Model (NAM), students' car use habits, and students' car access. The psychological factors analyzed in this study are students' awareness of consequences of car use (AC), students' ascription of responsibility of car use (AR), students' personal norm of car use (PN), students' car use habits (H), and students' car access for traveling to campus (CA).

It is expected that the research findings will be beneficial for designing campus transportation policies designed for reducing students' car usage for university routes. Findings on the psychological factors that mostly affect students' actual car use behavior for traveling to campus can provide recommendations in considering both psychological and structural interventions, which need to be implemented by the campus to affect students' actual behavior using cars for traveling to campus.

2. Methods

A convenience sample of university students from three private universities in Surabaya, Indonesia: (1) Widya Mandala Catholic University (WMCU), (2) Surabaya University (SU), and (3) Petra Christian University (PCU) [22], were approached to participate in the study. 312 students (136 female, 176 male) completed the study. The breakdown of students was as follows: 53 WMCU, 124 SU, 135 PCU; 86 have one car, 125 have two cars, 72 have three cars, 29 have four or more cars; and 264 have access to at least one car for traveling to campus, and 48 have access to two or more cars for traveling to campus. The study utilized a self-report paper and pencil questionnaire. Each latent variable has three or more indicators, with exceptions for students' car access and students' actual behavior using car for traveling to campus (Table 1).

Table 1. Indicators Used for the Latent Variables

Latent Variable	Number of Item	Cronbach's α	Construct Reliability	Variance Extracted
Actual car use behavior (AB)	1	n/a	n/a	n/a
Behavioral intention to use car (BI)	4	0.63	0.743	0.420
Personal norm to reduce using car (PN)	4	0.60	0.700	0.373
Ascription of responsibility to reduce using car (AR)	3	0.76	0.768	0.525
Awareness of consequences to reduce using car (AC)	3	0.69	0.767	0.525
Car access for traveling to campus (CA)	1	n/a	n/a	n/a
Car use habit for traveling to campus (H)	7	0.91	0.910	0.595

3. Results

An estimation of the model was determined using the Analysis of Moment Structure (AMOS) [23] and Table 2 shows the results that met the statistical portion of the suitability of the model. There are three invalid constructs with Variance Extracted (VE)<0.50, i.e. PN (0.373), and BI (0.420), but all of the invalid constructs are qualified CR $\geqslant$ 0.70 (Table 1). The Model is assumed optimum because Modification Indices (MI) did not propose any addition of

error covariance that can increase model goodness of fit, and increases validity and reliability model constructs significantly.

Fig. 1 shows the structural model of NAM. All Standard Loading Factors (SLF) are significant ($p \leq .05$). Construct AC and AR gives significant positive influence to PN, construct PN gives significant negative influence to BI, and construct BI gives significant positive influence to AB.

Table 2. Model Goodness of Fit

Goodness of Fit Indicators	NAM	NAM+CA	NAM+H	NAM+CA+H
Absolute-Fit Measures				
χ^2 (Chi-Square)	1,039.666	1,009.059	849.459	789.633
Significance of Probability	0.000	0.000	0.000	0.000
Degree of Freedom	215	214	212	210
CMIN/df	4.836	4.715	4.007	3.760
GFI	0.764	0.776	0.813	0.827
RMR	0.178	0.178	0.126	0.114
RMSEA	0.111	0.109	0.098	0.094
Incremental-Fit Measures				
TLI	0.693	0.702	0.759	0.779
NFI	0.695	0.704	0.751	0.769
AGFI	0.698	0.711	0.756	0.773
RFI	0.641	0.650	0.703	0.721
IFI	0.742	0.751	0.801	0.819
CFI	0.739	0.748	0.798	0.816

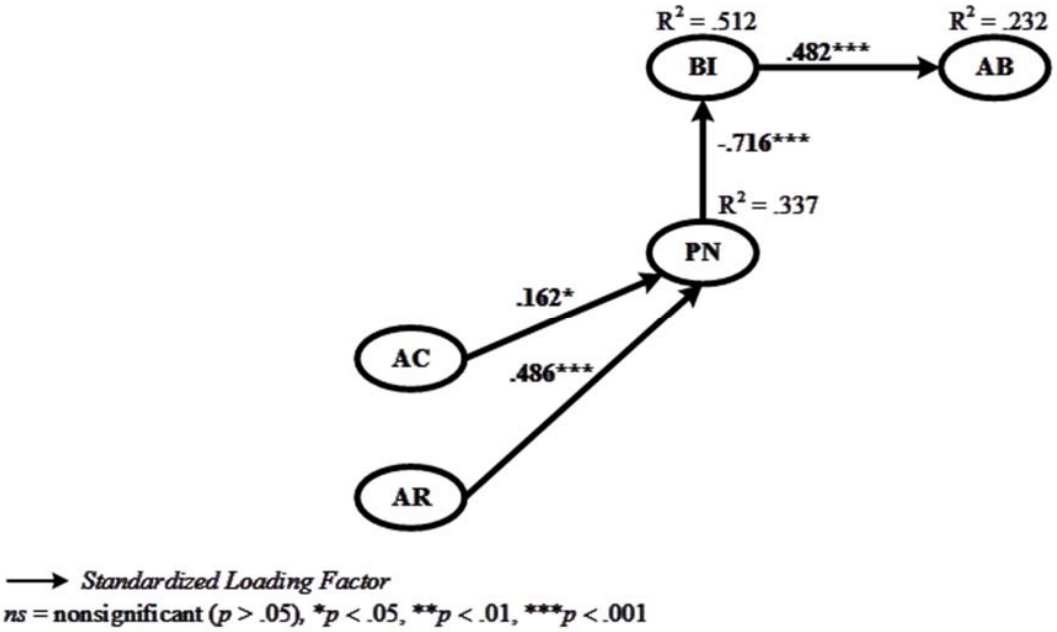

Fig. 1. Structural Model of NAM

Based on the NAM structural model, increasing students' awareness of consequences to reduce using cars (AC) and ascription of responsibility to reduce using cars (AR) will increase students' personal norms (PN) to reduce using cars for traveling to campus, while increasing of PN will decrease or reduce students' behavioral intention to use cars (BI) for traveling to campus. Therefore, the decreasing or reducing of BI will decrease or reduce students' actual car use behavior (AB) for traveling to campus. AC and AR explained about 34% variance of PN, whereas construct PN

can explain about 51% variance of BI, and about 23% variance of AB explained by BI. Construct PN is significantly affected both by construct AR and AC.

Fig. 2 shows the structural model of NAM+CA. All standard loading factors (SLF) are significant ($p \leq .050$), except for the effect of AC to PN ($p = .057$). Construct AR gives significant positive influence to PN, construct PN gives significant a negative influence on BI, while construct BI and CA gives a significant positive influence on AB.

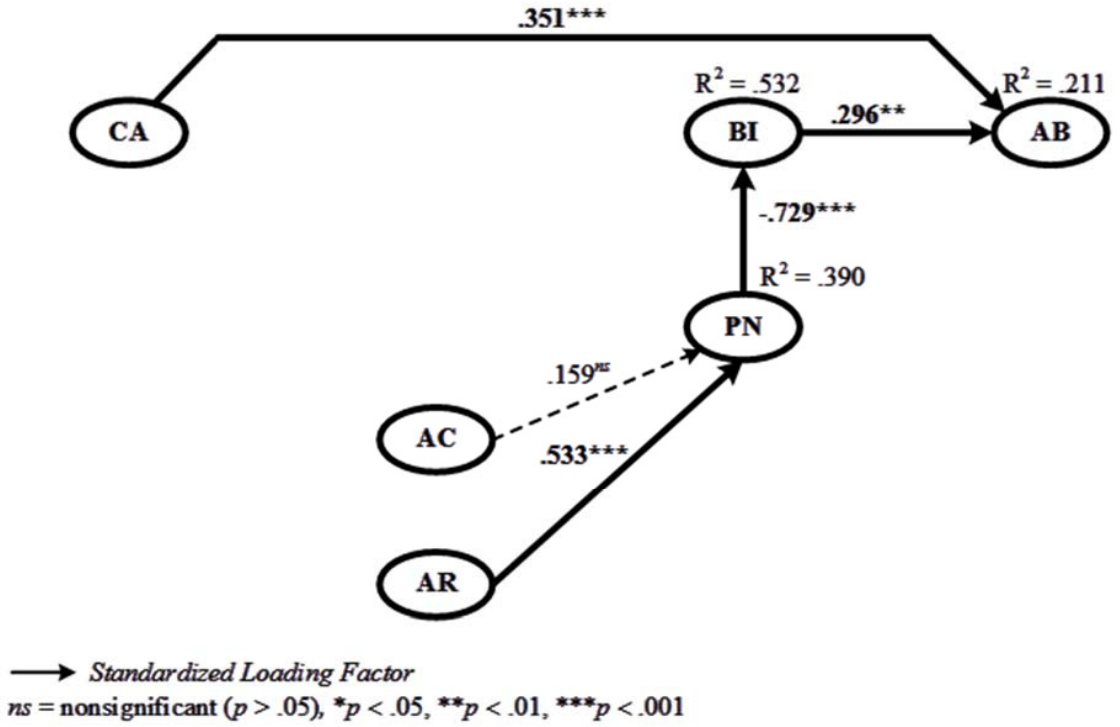

Fig. 2. Structural Model of NAM+CA

Based on the NAM+CA structural model, the increasing of AR will increase PN. Increasing PN will decrease or reduce BI, while increasing of students' car access for traveling to campus (CA) and BI will increase of AB. AC and AR explained about 39% variance of PN (an increase of about 16% compared with previous model, NAM), whereas construct PN can explain about 53% variance of BI (an increase about 4% compared with NAM), and about 21% variance of AB explained by BI and CA (a decrease about 9% compare with NAM). Construct PN is only affect by construct AR.

Fig. 3 shows the structural model of NAM+H. All standard loading factors (SLF) are significant ($p \leq .050$), except for the effect of H to AC ($p = .528$) and H to AR ($p = .882$). Students' car use habits for traveling to campus (H) has a significant negative influence on PN, and a significant positive influence on AB. AC and AR have a significant positive influence on PN, while PN has a significant negative influence on BI, and BI has a significant positive influence on AB.

Based on the NAM+H structural model, although increasing AC and AR will increase PN, increasing H will decrease PN. In this model, PN is affected both by positive and negative influence, while AB is more influenced by H than by BI. H, AC and AR explained about a 63% variance of PN (an increase of about 61% compared with the previous model, NAM+CA), whereas construct PN can explain a 48% variance of BI (a decrease of about 11% compared with NAM+CA), and about 53% variance of AB is explained by BI and H (an increase of about 153% compared with NAM+CA).

Fig. 4 shows the structural model of NAM+CA+H. All standard loading factors (SLF) are significant ($p \leq .05$), except for the effect of H to AC ($p = .528$) and H to AR ($p = .890$). CA has both a significant positive influence on H ($p \leq .001$) and AB ($p = .039$). H has a significant negative influence to PN ($p \leq .001$), and a significant positive influence on AB ($p \leq .001$). Both AC and AR give a significant positive influence on PN ($p = .040$ and $p \leq .001$), while PN gives a significant negative influence on BI ($p \leq .001$), and BI gives a significant positive influence on AB ($p = .025$).

Based on the NAM+CA+H structural model, the increasing of students' car access for traveling to campus (CA) will increase students' car use habits for traveling to campus (H), and students' actual car use behavior (AB). Increasing of students' car use habits for traveling to campus (H) will decrease students' personal norms to reduce using cars (PN), but also increase students' actual car use behavior (AB). About 19% of the variance in H was explained by students' car access for traveling to campus (CA), whereas H, awareness of consequences to reduce using cars (AC), and ascription of responsibility to reduce using cars (AR) can explain about 63% variance of PN (almost the same as the previous model, NAM+H). About a 47% variance of BI explained by PN (a decrease about 0.2% compared with NAM+H), and about 54% of the variance in AB, was explained by H and CA (an increase of about 1.5% compared with NAM+H).

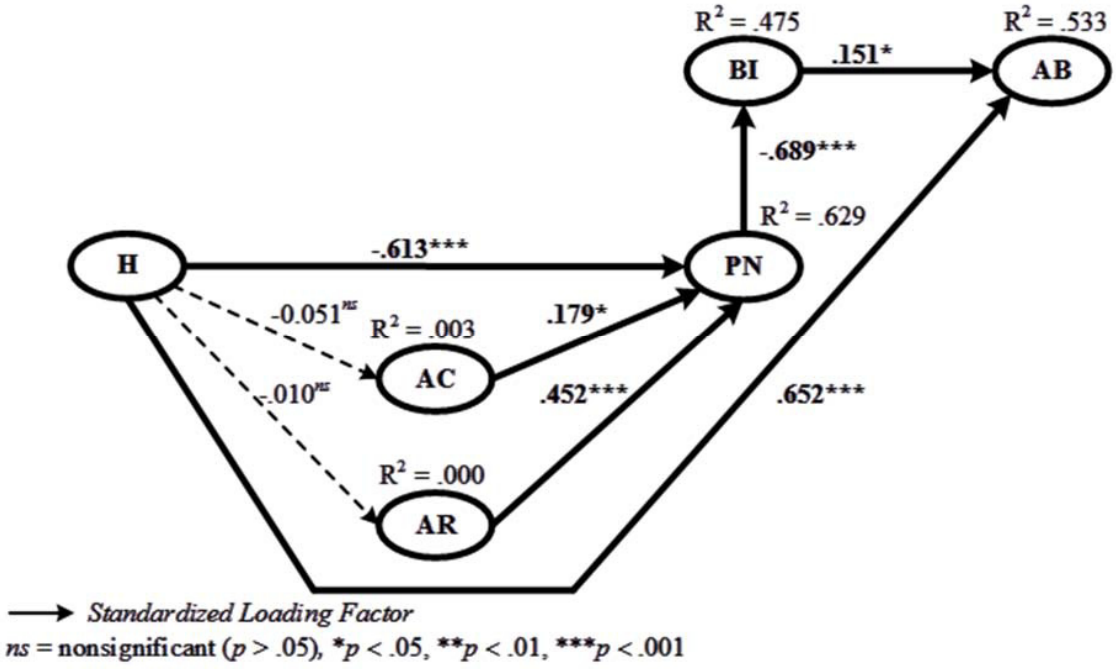

Fig. 3. Structural Model of NAM +H

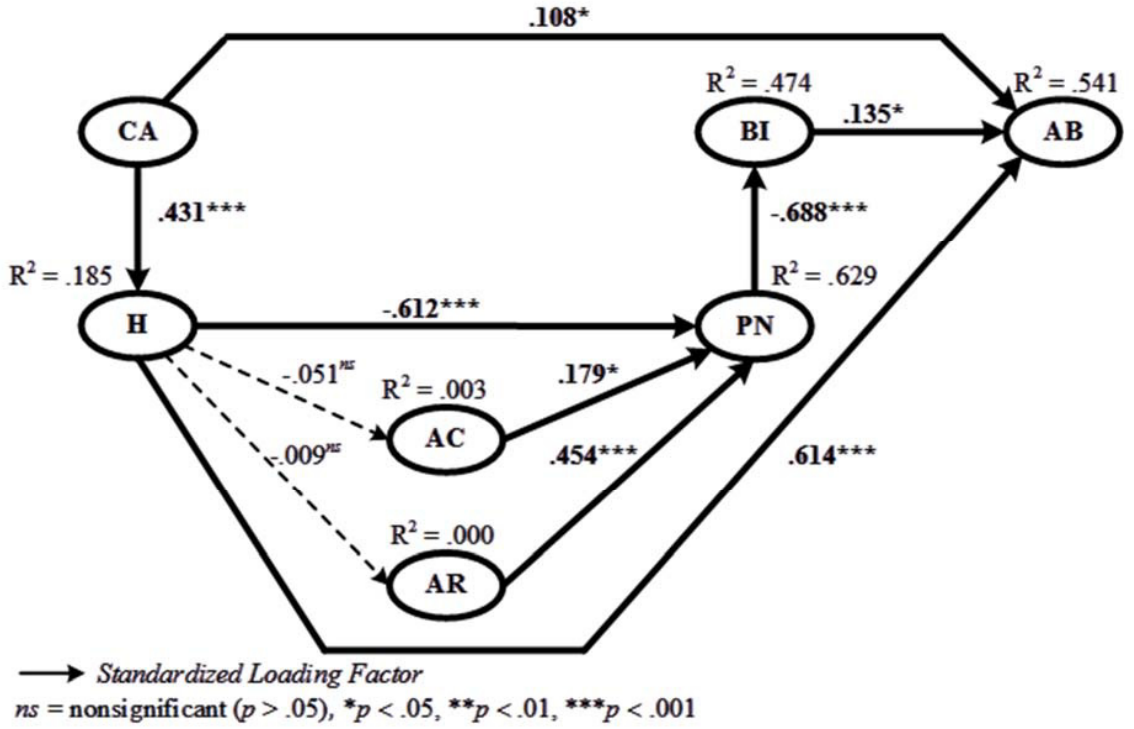

Fig. 4. Structural Model of NAM+CA+H

4. Discussion

A behavior model is an approach to finding out the psychological factors that mostly affect students' behavior to reduce using cars for traveling to campus. Such information is a useful input in devising various campus transport policies. Several findings can be obtained based on the relationships between psychological factors in NAM, NAM+CA, NAM+H, and NAM+ CA+H structural models. The goodness of fit of the model is gets better along with the addition of CA and H (Table 2). Both AR and AC give a positive influence on PN, although influence of AR on PN is always greater than the influence of AC on PN.

Adding H to NAM and NAM+CA gives a significant negative influence of H on PN. Thus, it can be said that the impact of H is very strong against altruistic behavior (NAM). Therefore, adding students' car use habits into the NAM not only significantly increased the explained variation in students' actual behavior, but also improved both the explained behavioral variation and a moderating effect of habits on the connection between personal norms, behavioral intention, and actual behavior.

Added CA and H in NAM (NAM+CA+H) have good effect, although reduce the influence of BI on AB and decrease BI variance. AB variance increase significantly, and the SLF between PN-BI and BI-AB is still significant. Therefore, the more students perceive that they have access to cars for commuting to campus, the stronger their habit to use cars for traveling to campus, their behavior intentions become insignificantly affect their actual behavior to use a car for traveling to campus.

Thus, campuses needs to develop strategies of intervention that are a combination of the structural interventions (hard transport measures) and the psychological intervention (soft transport measures), 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' sense of responsibility (ascription of responsibility) with regard to the negative impact of using cars for traveling to campus.

Structural intervention can be either facility (such as student dormitories, restricted parking locations inside the campus area, preferential parking spaces for ride sharing, and bicycle facilities). Other structural interventions can be either financial disincentives or incentives (e.g., the enforcement of more expensive parking fee rates for those who drive alone, and free parking for ride sharing and vanpool participants, guaranteed ride home for car-share and vanpool participant, the chance to try a vanpool service free of charge, and ease of bicycle installment plan). Meanwhile, psychological intervention can be in the form of campaigns and educational programs (e.g., the positive impact of using others modes of transport for traveling to campus, and travel awareness campaigns that raise awareness of the negative impact of using cars). Another form of psychological intervention is a ride sharing and public transport marketing information scheme, and personalized travel planning.

5. Conclusions

This study explored the relationship between the various psychological factors that affect the students' behavior to reduce car use for traveling to campus based on the Norm Activation Model (NAM), with the addition of students' car access (CA), and car use habits (H) for traveling to campus. Overall, the results highlight that students' car use habits for traveling to campus and students' ascription of responsibility (AR) to reduce using cars were the strongest factors that influence students' personal norm (PN) to reduce using cars, and students' car use habits were the strongest factors that influence students' actual car use behavior, while students' car access significantly influenced students' car use habits and students' actual car use behavior. Finally, students' actual car use behavior were more influence by students' car use habits, than by students' intentions of using cars, and by students' car access for traveling to campus.

Although, students' personal norms to reduce using cars negatively influenced students' behavioral intentions to use cars. Students' car usage habits and car access for traveling to campus had a positive influence on students' actual car use behavior. Thus, if the student has developed a strong car use habit in the previous semester and have easy access to use a car, they are very likely to use the car for traveling to campus. Furthermore, students' car use habits are also influenced by students' car access.

The results of the research have implications for university policy, that in order to alter the use of cars, universities should implement both structural and psychological interventions. To be effective interventions should be designed to remove opportunities for the enactment of car use habits, and specifically attempting to raise the students' sense of responsibility towards the negative impact of car use.

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