Comparative Analysis of Transportation Mode Choices Between Students of the University of the Philippines Diliman (UPD) and the Ateneo de Manila University (ADMU)

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Abstract: In response to climate change, universities around the world are promoting sustainable transportation. The current study examines the mode choices of students from Ateneo de Manila University (ADMU) and the University of the Philippines Diliman (UPD) using a Multinomial Hybrid Choice Model, incorporating environmental awareness as a latent variable. Results show that UPD students primarily use public transport, while ADMU students prefer ride-hailing and private vehicles. Environmental awareness influences mode choice for ADMU students but not for UPD students. Across both universities, travel time is the most important factor, while environmental impact is the least influential.

Keywords: Multinomial Hybrid Choice Model, Mode Choice, Environmental Awareness, Sustainable Transportation, University Students

1. INTRODUCTION

Climate change has become increasingly evident in the Philippines in recent years. GMA Integrated News (2024) reported that Zambales recorded the country's highest-ever heat index on 26 May 2024. Additionally, the Philippines experienced an unprecedented sequence of six consecutive typhoons within a single month—an event linked to the intensifying effects of climate change (Tandon, 2024). Greenhouse gases, particularly carbon emissions, are major drivers of climate change. A significant source of these emissions is the transportation sector, which is especially concentrated in urban areas (Tiseo, 2024).

In response, numerous city governments have implemented sustainable mobility programs, policies, and projects aimed at reducing carbon emissions by promoting alternative, eco-friendly transportation modes. Within cities, university campuses play a crucial role in shaping urban mobility patterns due to many staff and students travelling daily (Rotaris & Danielis, 2014). These campuses are valuable sites for studying sustainable mobility, as they are not only traffic generators but also active implementers of mobility initiatives alongside government programs. Moreover, universities can influence students' transportation choices through awareness campaigns and infrastructure that support sustainable transportation.

Environmental awareness is a key factor in encouraging sustainable mobility. According to Kliber et al. (2024), higher environmental awareness correlates with a stronger preference for sustainable transport options. However, there is a lack of empirical data validating this relationship within the Philippine context. The country has uniqueness in terms of culture, socioeconomic conditions, topography, and environmental challenges. Despite the availability of environmentally friendly transportation modes, the use of private vehicles in the Philippines

continues to rise. It remains unclear whether students' environmental awareness significantly influences their mode of transportation, particularly in higher education institutions such as the University of the Philippines Diliman (UPD) and Ateneo de Manila University (ADMU).

This study aims to address this gap by examining whether environmental awareness affects the transportation mode choice among students from UPD and ADMU. By comparing a public and a private university, the current research investigates whether differences in institutional context, access to resources, and exposure to sustainability initiatives, affect the transportation mode choice of university students. The findings will contribute to the global discourse on sustainable urban mobility and support the achievement of the United Nations Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action). Insights from this study can inform the development or refinement of mobility policies and serve as a foundation for future research.

This study focuses on students from UPD and ADMU, both located in Quezon City, Metro Manila, and both implementing sustainable mobility policies to promote environmental awareness. Their proximity and similar urban context allow a good comparison, with UPD representing public universities and ADMU representing private institutions. Given their large student populations and significant impact on local traffic patterns, this research is limited to analyzing students' trips between their residences and respective campuses.

2. REVIEW OF LITERATURE

2.1. Transportation Mode Choices

Mode choice refers to the decision-making process individuals undergo when selecting a specific mode of transportation for a given trip. With a wide range of options available, commuters base their decisions on various personal and systemic factors, such as *income* (e.g. Ashalatha et al., 2013; Rith et al., 2019), *age* (Islam, 2019; Ashalatha et al., 2013), *attributes of the transportation system* (Mehta, 2025; Mayo & Taboada, 2019), *safety considerations* (Mayo & Taboada, 2019), and *environmental concerns* (Bouscasse et al., 2018). In the Philippine setting, common travel modes include walking, biking, e-vehicles, jeepneys, buses, trains, private motorcycles, and private cars.

Promoting a higher share of sustainable transportation modes is critical in achieving urban *efficiency* (Partida, 2025), *equity* (Ali, 2024), and *livability* (Telefonica, 2023). Rodrigue (2017) defines sustainable transportation as the ability to meet society's mobility needs with minimal environmental impact, thereby safeguarding mobility for future generations. Among the modes of transportation, aside from active transport, trains are the most sustainable, followed by e-vehicles, buses, and cars (Modeshift, 2023). The hypothesis of the current study is that students enrolled in universities with sustainable mobility programs are more likely to use sustainable transportation modes.

2.2. Sustainable Mobility InitiativMorckes Within Universities

Sustainable mobility initiatives encompass policies, programs, and infrastructure projects aimed at moving people and goods efficiently while supporting economic, social, and environmental goals. In university settings, common initiatives include the promotion of active transportation (Thammasat University - Thailand, 2023), the provision of subsidized or free transit passes (Campus Services Office - HKUST, 2022), campus shuttle services, parking management strategies (Promoting Sustainable Commuting at BSRU, 2023), and awareness

campaigns (Sustainability at UoP - Transportation, 2024).

In the Philippines, UP Diliman (UPD) promotes environmentally responsible commuting through pedestrian lanes, sidewalks, bike lanes, bike racks, and the UP-Bike Share program. The campus also provides charging stations for e-trikes, e-scooters, and e-bikes (Regidor, 2022). Similarly, Ateneo de Manila University (ADMU) supports sustainable mobility by developing bike lanes, bike racks, pedestrian pathways, and a covered walkway network, along with operating electric jeepneys within the campus (Ateneo Institute of Sustainability, 2021). These initiatives are expected to increase students' environmental awareness, which may, in turn, influence their transportation choices.

2.3. Determinants of Travel Mode Choice Among University Students

Cattaneo et al. (2018) found that longer travel distances often encourage students to opt for public transportation modes, such as buses and trains, over private vehicles. Similarly, Rith et al. (2019) noted that shorter walking distances to transit stations and greater transit line density significantly reduce private car usage, emphasizing the importance of accessibility in promoting sustainable travel. Cost also plays a critical role. Collins and Chambers (2005) concluded that affordability strongly influences the preference for public transport, whereas Mayo and Taboada (2020) observed that, despite rising costs, many commuters still favored private and for-hire vehicles over mass transit. Moreover, travel time is another key factor. Miralles-Guasch and Domene (2010) highlighted that long commute times deter commuters from shifting from private vehicles to public or active transportation modes.

In terms of mode transfer, Ha et al. (2020) found that commuters who needed to make more than one transfer were 24.3% more likely to choose driving instead, underscoring the importance of minimizing inconvenience and ensuring seamless connectivity between modes. Finally, physical activity also influences transportation choices. Simons et al. (2013) and Morckel & Terzano (2013) reported that individuals who walk or bike as part of their commute tend to maintain higher levels of overall physical activity compared to those who rely on cars or public transportation.

To design effective sustainable mobility policies, it is crucial to understand the factors influencing university students' transportation choices. The current study focuses on five key determinants: travel distance, travel cost, travel time, mode transfer, and the opportunity for physical activity.

2.4. Environmental Awareness

In addition to conventional determinants, environmental awareness is a critical factor influencing transportation mode choice. However, the literature presents mixed findings. Sobrino and Arce (2021) found that environmental awareness ranked low in terms of priority for most travelers, indicating a need for stronger efforts to link personal travel habits to climate change impacts. Zavareh et al. (2020), on the other hand, concluded that while environmental awareness influences general attitudes, it does not significantly affect the use of active transportation. Similarly, Vazquez-Paja et al. (2024) found a gap between environmental awareness and actual behavior, suggesting that awareness alone is insufficient unless supported by pro-environmental actions.

Several studies demonstrate a positive correlation between environmental awareness and sustainable transportation choices. Kliber et al. (2024) found that environmentally aware individuals are more likely to choose modes other than cars. Cattaneo et al. (2018) also observed a 5.8% reduction in car usage when environmental awareness was heightened, showing its

potential as a behavioral driver.

2.5. Hybrid Choice Model

To accurately analyze transportation mode choice while accounting for latent variables such as environmental awareness, researchers often employ Hybrid Choice Models (HCMs). These models enhance traditional discrete choice models by integrating unobservable psychological factors, providing a more comprehensive understanding of travel behavior (Kim et al., 2014). The four main types of discrete choice models are Nested Logit (NL), Heteroscedastic Extreme Value (HEV), Mixed Logit, and Multinomial Logit (MNL) models (Yu & Sun, 2012). The MNL model is particularly useful when dealing with nominal variables with more than two unordered alternatives (National University, 2025). It leverages all categories in the dataset to improve statistical reliability and estimate outcome probabilities (Columbia University Irving Medical Center, 2016). The Multinomial Hybrid Choice Model (MNL-HCM) incorporates latent variables, such as environmental awareness, into the MNL framework, allowing for more realistic behavioral modeling. Bolduc et al. (2008) demonstrated that hybrid models provide more accurate representations of real-world decision-making.

The current study employs a Multinomial Logit Hybrid Choice Model (MNL-HCM) incorporating a MIMIC (Multiple Indicators and Multiple Causes) structure to assess the impact of environmental awareness on transportation mode choice. Considering the diverse range of transportation options available to students and the significant role of psychological factors, this modeling approach is well-suited to the study's analytical framework.

3. METHODOLOGY

3.1. Research Framework

This study followed the research framework illustrated in Figure 1, which consists of three key components: data collection, the multinomial hybrid choice model, and mode choice model formulation. Data were collected through surveys capturing environmental awareness indicators, socioeconomic characteristics, and mode-related factors to analyze their influence on students' environmental awareness. Subsequently, environmental awareness, combined with socioeconomic and mode-related factors, was used to estimate its effect on transportation mode choice. The results were then applied to develop a choice model for both public and private university students, followed by validation. The dataset was divided into a training set (70%) for model calibration and a test set (30%) for validation. For this study, transportation modes were classified into four categories: (1) active transportation, (2) public transportation, (3) ride-hailing services, and (4) private motorized vehicles.

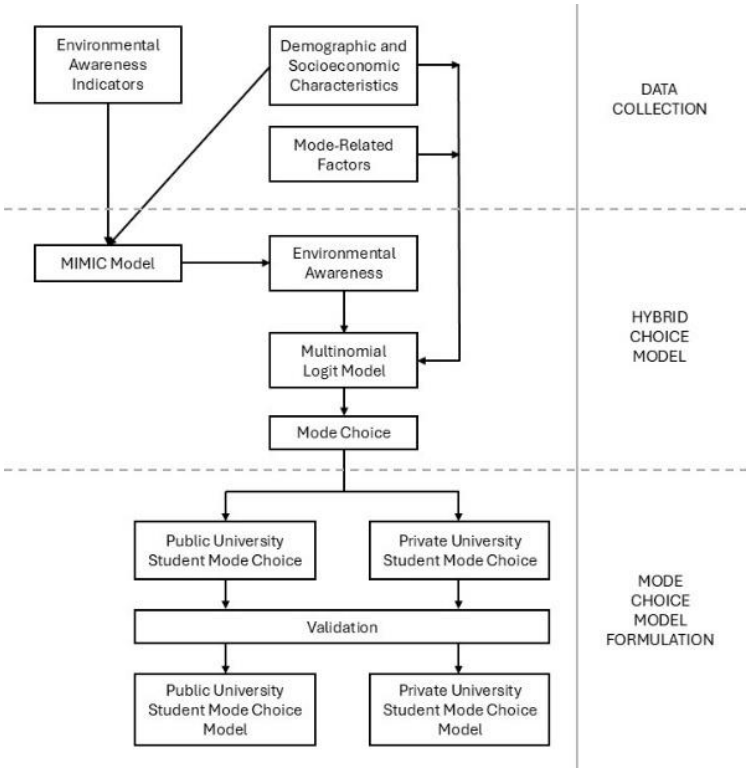

Figure 1. Mode choice study framework

3.2. Data Collection

Data used in this study was collected through a questionnaire distributed to students from UPD and ADMU. The survey consisted of three main sections: socioeconomic characteristics, mode choice determinants, and environmental awareness. It also included questions on students' preferred transportation modes and their willingness to shift from conventional to more sustainable options. Data collection was conducted from February to April 2025.

3.3. Multinomial Hybrid Choice Model Development

The study used a multinomial hybrid logit or choice model where a latent variable was incorporated to capture the environmental awareness of the university students (Vazquez-Paja et. al., 2024). The multinomial hybrid choice model consists of two statistical models, which are the MIMIC model and the multinomial logit model.

The latent variable was estimated using the MIMIC (multiple indicators, multiple causes) model which is made up of two equations: the measurement equation, explaining the relationship between the indicators and the latent variable; and the structural equation, explaining the relationship between the latent variable and the socioeconomic characteristics and/or mode choice determinants.

3.4. Model Validation

After estimating the model, a confusion matrix was used for model validation. The confusion matrix evaluates how well the model's predicted classifications align with the actual outcomes.

Based on this matrix, performance metrics such as accuracy and the No Information Rate (NIR) were computed to assess the model's predictive capability.

4. RESULTS AND DISCUSSION

4.1. Respondent's profile

The total number of valid responses was 260, consisting of 200 students from UPD and 60 students from ADMU. The dataset was divided into two subsets for model calibration (training set) and validation (test set). Table 1 presents the demographic profile of the 70% of UPD respondents. Of these, 59.5% were male and 40.5% were female. Most respondents (95.5%) were 17–24 years old, while 4.5% were 25–30 years old. A majority (92.5%) were undergraduate students, while 7.5% were graduate students. In terms of monthly family income, 5.5% reported less than ₱9,100; 11% had ₱9,100–₱18,200; 26% fell within ₱18,200–₱36,400; 18.5% had ₱36,400–₱63,700; 15.5% had ₱63,700–₱109,200; 11% were ₱109,200–₱182,000; and 12.5% had above ₱182,000. Furthermore, 43.5% of the respondents held scholarships. In terms of student status, 80% were full-time students and 20% were working students. Regarding residence, 19% lived on campus, 45.5% lived outside the campus but within Quezon City, and 35.5% lived outside Quezon City.

Table 1. Profile of Respondents from UPD and ADMU

	UPD	ADMU
GENDER		
Male	119	42
Female	81	18
AGE		
17 years old	1	-
18 years old	34	2
19 years old	53	11
20 years old	30	13
21 years old	29	14
22 years old	21	14
23 years old	17	5
24 years old	6	-
25 years old	2	1
26 years old	2	-
28 years old	4	-
30 years old	1	-
LEVEL OF STUDY		
Undergraduate	185	60
Graduate	15	-
MONTHLY INCOME		
Less than 9,100	11	1
9,100 to 18,200	22	1
18,200 to 36,400	52	3
36,400 to 63,700	37	8
63,700 to 109,200	31	20
109,200 to 182,00	22	12

Above 182,000	25	15
WITH SCHOLARSHIP		
Yes	87	11
No	113	49
WORKING STUDENT		
Yes	40	5
No	160	55
CURRENT RESIDENCE		
Within campus	38	1
Outside campus but within Quezon City	91	33
Outside Quezon City	71	26

Table 1 also shows that 70% of ADMU respondents were male and 30% female. All respondents (100%) fell within the 18–25 age bracket and were undergraduate students. Regarding monthly family income, 1.67% reported less than ₱9,100; 1.67% had ₱9,100–₱18,200; 3.33% fell within ₱18,200–₱36,400; 13.33% had ₱36,400–₱63,700; 33.33% had ₱63,700–₱109,200; 20% were within ₱109,200–₱182,000; and 15% had above ₱182,000. Additionally, 18.3% of respondents had scholarships, while 81.7% did not. Of the 60 respondents, 91.7% were full-time students and 8.3% were working students. In terms of residence, 1.7% lived on campus, 55% lived outside the campus but within Quezon City, and 43.3% lived outside Quezon City.

4.2. Estimation of the environmental awareness variable

Environmental awareness is the latent variable being considered. The MIMIC model was utilized to evaluate the latent variable using the JASP software and the data collected from the university students. The five environmental awareness indicators were incorporated in the model, while the predictors included in the model were sex, age, degree program, family income, job, and type of residence. Two sets of statistical analysis were performed depending on the respondents included in the analysis: (1) UPD university students only and (2) ADMU university students only.

4.2.1. Environmental awareness of UPD university students

Only the age and degree program were found to be significant among all the predictors incorporated. Table 2 shows the estimates and standard errors of the age and degree programs with significance levels under 10% and 5%, respectively.

Table 2. Predictor coefficients using the MIMIC model

PREDICTOR	ESTIMATE	Z
Age	-0.049	0.083*
Degree Program	0.349	0.037**
INDICES	VALUE	
Chi-square	< 0.001	
Comparative Fit Index	0.983	
RMSEA	0.493	

*, ** indicate significance at the 10% and 5% levels, respectively

Based on the result, age negatively influences the environmental awareness of university students. Older students tend to have lower environmental awareness. Meanwhile, the degree

program related to environmental studies and concerns with carbon emissions has a positive effect on the environmental awareness of the university students. Several goodness of fit tests was conducted and concluded that UPD university students' environmental awareness model is well fitted as shown in Table 4-2: the probability of the chi-square (χ^2) statistic is less than 0.05; the Comparative Fit Index (CFI) is greater than 0.95; and the root mean square error of approximation (RMSEA) is less than 0.05. Thus, the null hypothesis can be rejected.

4.2.2. Environmental awareness of ADMU university students

None of the socioeconomic characteristics were found to be significant predictors of the environmental awareness of ADMU university students. Therefore, only indicators will be used to estimate the environmental awareness of the students. The calibrated model of UPD university students' environmental awareness is well fitted as shown in Table 3: the probability of the chi-square (χ2) statistic is less than 0.05; the Comparative Fit Index (CFI) is greater than 0.95; and the root mean square error of approximation (RMSEA) is less than 0.05. Thus, the null hypothesis can be rejected.

Table 3. ADMU university students' environmental awareness model goodness of fit

INDICES	VALUE
Chi-square	< 0.001
Comparative Fit Index	1.00
RMSEA	< 0.05

4.3. Calibration of transportation mode choice model

The Hybrid Choice Model was utilized to analyze the transportation mode choice of university students using the Jamovi software and data collected through the survey. Due to the wide variety of mode choices among the respondents, the mode choices were categorized into four groups: Active Transportation, Public Transportation, Ride-Hailing, and Private Motorized Transportation. The following specific modes in each group are listed in the table below (see Table 4).

Table 4. Transportation mode groups

TRANSPORTATION MODE		CARBON EMISSION (g CO_2 / p-km)
Active	Walk	0
	Bicycle	0
	E-Bike	13–24 (indirect)
	E-Scooter	20–37(indirect)
Public	E-Trike	28–54 (indirect)
	E-Jeep	52–72 (indirect)
	Train (Electric)	14–21(indirect)
	Jeep	28–45
	Bus	48.4
Ride Hailing	Tricycle	118
	MotoTaxi	118
	Taxi	94
Private Motorized	Car	94
	Motorcycle	118

Source: Department of Energy Philippines (2019), Rito et al. (2021) and Asian Development Bank (2022)

As shown in the table above (Table 4), active modes are the most sustainable, having zero direct carbon emissions. Meanwhile, E-Bikes and E-Scooters have indirect carbon emissions resulting from charging and maintenance, but they can be reduced if renewable energy is used, followed by public transportation modes contributing low carbon emissions per passenger-kilometer (g CO_2 / p-km) due to their high passenger load capacity. Last is the ride-hailing and private motorized vehicles, which are considered unsustainable.

In the Hybrid Choice Model, the transportation mode choice set that was considered consists of three alternatives that are classified based on the carbon emissions of the respondents' regularly used modes: active transportation, public transportation, and a combination of ride-hailing and private motorized vehicles. Ride-hailing and private motorized vehicles were analyzed as one because they both have high carbon emissions, ranging from 94 to 118 g CO2 / p-km. Also, the latter was used as the reference alternative in the model.

4.3.1. Mode choice model of UPD university students.

The multinomial hybrid choice model was defined and estimated using Jamovi software version 2.6.26. Simultaneously, an omnibus likelihood ratio test was conducted to ascertain the significance of predictors in the model. As shown in Table 5, the number of days of exercise per week, travel time, whether the monthly family income falls within the poor to low middle class or middle-middle class to rich range, the number of days the student goes to campus, age, living with family, and cost significantly affect the transportation mode choice of UPD students.

Table 5. Omnibus likelihood ratio test results for UPD students

PREDICTOR	χ^2	df	p
Cost	49.95	2	<.001
Travel Time	8.54	2	0.014
Exercise	10.26	2	0.006
Days on Campus	12.38	6	0.054
Family Income	20.45	2	<.001
Type of Residence	10.50	2	0.005
Age	7.46	2	0.024

The result of the hybrid choice model is shown in Table 6, where significant predictors are listed with their respective estimates, standard error, z-value, and significance level.

Table . Hybrid choice model results for UPD university students.

MODE	PREDICTOR	ESTIMATE
Active	Intercept	-12.88**
	Cost	-1.16**
	Travel Time	-3.39**
	Exercise	41.86**
	Days on Campus:	
	2 – 0	132.20**
	1 – 0	55.31**
	Type of Residence:	
	1 – 0	17.29**
	Age	1.71**
Public	Intercept	14.26**
	Cost	-5.62e−4**
	Travel Time	0.02**
	Exercise	-0.20*
	Days on Campus:	

3 – 0	-2.16**
2 – 0	-2.83**
1 – 0	-1.98**
Family Income:	
1 – 0	-2.33**
Type of Residence:	
1 – 0	-1.86**
Age	-0.36**

*, ** indicate significance at the 10% and 1% levels, respectively

Thus, the final model for UPD university students is given by the following utility functions, with travelling by ride-hailing or private motorized vehicle being the reference alternative:

$$U_{active} = \alpha_{active} + \beta_{ttime}^{active} \times TTIME + \beta_{cost}^{active} \times COST + \beta_{exercise}^{active} \times EXERCISE + \beta_{dcampus}^{active} \times DCAMPUS + \beta_{tres}^{active} \times TRES + \beta_{age}^{active} \times AGE + \varepsilon_{active} \quad (1)$$

$$U_{public} = \alpha_{public} + \beta_{ttime}^{public} \times TTIME + \beta_{cost}^{public} \times COST + \beta_{exercise}^{public} \times EXERCISE + \beta_{dcampus}^{public} \times DCAMPUS + \beta_{fincome}^{public} \times FINCOME + \beta_{tres}^{public} \times TRES + \beta_{age}^{public} \times AGE + \varepsilon_{public} \quad (2)$$

where,

U_i	: utility of mode i
α_i	: intercept of mode i
β_x^i	: coefficient vector of variable x
TTIME	: travel time from residence to campus (minutes)
COST	: monthly cost involved in accessing the regularly used mode (Php)
EXERCISE	: number of days per week spent exercising
DCAMPUS	: number of days the student goes to campus
FINCOME	: monthly family income (Php)
TRES	: type of residence (1 = living with family, 0 = otherwise)
AGE	: age of the student
ε_i	: error term

Cost negatively affects the probability of UPD students choosing active and public transportation. As transportation expenses increase, the utility of selecting active or public transport modes decreases (Almasri & Alraee, 2013). Regarding travel time, shorter travel times increase the likelihood of choosing active modes. Interestingly, travel time shows a positive effect on the probability of choosing public transportation, which contrasts with the findings of Alomari et al. (2022), who noted that longer travel times discourage students from using public transport for commuting to the university. Additionally, the number of days a student exercises per week strongly correlates with a preference for active transportation over other modes. According to Flugel et al. (2021), individuals who engage in regular physical activity may be more inclined to choose active modes due to their perceived health benefits.

Aside from mode-related factors, other variables were found to be significant: the number of days the student goes to campus, family income, living with family, and age. The preference for active transportation increases with the number of days a student goes to campus. According to Barranco-Ruiz et al. (2019), this factor is multifaceted and often linked to proximity—students who frequently visit campus are more likely to use active modes if they live nearby or

within the campus. Family income, on the other hand, shows a clear preference for ride-hailing or private motorized vehicles. Individuals from higher-income households are more likely to use ride-hailing services due to convenience (Geiger, 2019) and tend to own multiple vehicles (Rith et al., 2019). Moreover, living with family positively influences the preference for active transportation, as parental perceptions of the built environment play a crucial role in encouraging active commuting (Molina-Garcia et al., 2025). Lastly, age also has a positive effect on the preference for active transportation, with most respondents (17–24 years old) being in an age group that is more inclined to walk or cycle (Meead et al., 2009).

Table 7. UPD university students' mode choice model fit measures

MODEL	R^2_{McF}	OVERALL MODEL TEST		
		χ^2	df	p
1	0.489	128	18	<.001

Goodness-of-fit measures were calculated (see Table 7), indicating that the calibrated mode choice model for UPD students is well-fitted: McFadden's pseudo-R^2 (R^2McF) exceeds 0.4, and the probability of the chi-square (χ^2) statistic is less than 0.05. These results suggest that the predictors in the model explain the mode choice behavior of UPD students effectively.

Afterwards, the developed model was validated using the test set through a confusion matrix. Table 48 presents the validation results, showing an accuracy of 0.80, which is higher than the no information rate (NIR) of 0.78. Therefore, the mode choice model for UPD students is considered reliable.

Table 8. UPD university students' mode choice model validation result

PREDICTION	REFERENCE			ACCURACY	NIR
	RH/PMV	Active	Public		
RH/PMV	11	0	8		
Active	0	0	1	0.80	0.78
Public	7	1	57		

4.3.2. Mode choice model of ADMU university students.

A similar analysis was conducted on the mode choice of ADMU university students. The omnibus likelihood ratio test yields the following results (see Table 9): travel distance, travel time, cost, and environmental awareness significantly influence the transportation mode choice of ADMU students.

Table 9. Omnibus likelihood ratio test results for ADMU students

PREDICTOR	χ^2	df	p
Travel Distance	18.46	2	<.001
Travel Time	5.76	2	0.056
Cost	6.29	2	0.043
Environmental Awareness	11.26	2	0.004

The result of the hybrid choice model is shown in Table 10, where significant predictors are listed with their respective estimates, standard error, z-value, and significance level.

Table 10. Hybrid choice model results for ADMU university students

MODE	PREDICTOR	ESTIMATE
Active	Intercept	0.81***
	Travel Distance	-15.87***
	Travel Time	0.68***
	Cost	-0.002**
	Environmental Awareness	12.78***
Public	Environmental Awareness	-0.82***

, * indicate significance at the 5% and 1% levels, respectively

After calculating, standardizing, and integrating the environmental awareness variable, the hybrid choice model was specified and estimated using Jamovi software. The final model for ADMU students is represented by the following utility functions, with ride-hailing and private motorized vehicles serving as the reference alternatives:

$$U_{active} = \alpha_{rhactive} + \beta_{ttime}^{active} \times TTIME + \beta_{cost}^{active} \times COST + \beta_{tdistance}^{active} \times TDISTANCE + \beta_{envaware}^{active} \times ENVAWARE + \varepsilon_{active} \quad (3)$$

$$U_{public} = \beta_{envaware}^{public} \times ENVAWARE + \varepsilon_{public} \quad (4)$$

where:

TDISTANCE : travel distance from residence to campus (in km)
ENVAWARE : estimated environmental awareness of students

Travel distance negatively affects the probability of ADMU students in choosing active transportation, indicating a stronger preference for ride-hailing services or private motorized vehicles. Regarding travel time, the results show that shorter travel times decrease the likelihood of choosing active transportation, as students tend to prefer ride-hailing services (Shi et al., 2021) or private vehicles (Pan & Isham, 2024) due to the time savings these modes provide. In terms of cost, higher transportation expenses increase the likelihood of students opting for ride-hailing or private motorized vehicles (Almasri & Alraee, 2013). Additionally, environmental awareness significantly influences mode choice; students with higher levels of environmental awareness are more likely to choose active transportation modes (Kliber et al., 2024).

Table 11. ADMU university students' choice model fit measures

MODEL	R^2_{McF}	OVERALL MODEL TEST		
		χ^2	df	p
1	0.420	51.8	8	<.001

The calibrated ADMU university students' mode choice model is well fitted, as shown in Table 11: McFadden's pseudo R^2 (R^2McF) is greater than 0.4 and the probability of the chi-square ($\chi 2$) statistic is less than 0.05. With this, the predictors in the model can explain the mode choice behavior of ADMU university students very well.

Table 12 presents the validation result with an accuracy of 0.29, lower than the no information rate (NIR) of 0.59. Thus, ADMU university students' mode choice model is poor

and lacking. One factor that caused the model to be deficient is the lack of responses from ADMU students.

Table 12. ADMU university students' mode choice model validation result

PREDICTION	REFERENCE			ACCURACY	NIR
	RH/PMV	Active	Public		
RH/PMV	4	1	2	0.29	0.59
Active	1	1	1		
Public	5	2	0		

4.4. Comparative analysis between UPD and ADMU mode choices.

A caveat must be noted when comparing the results between the two universities, as the analysis in section 4.3.2 indicates that the number of student responses from ADMU is insufficient. Consequently, the comparison applies only to the current sample and should not be used to generalize the broader population.

The current study shows that there is a clear difference in the preferred mode of transportation between UPD and ADMU university students, and the factors that affect them. Figure 2 presents the distribution of university students' transportation mode choice, where most of the respondents from UPD (74%) prefer to use public transportation, while most of the respondents from ADMU (52%) prefer to use ride-hailing or private motorized vehicles.

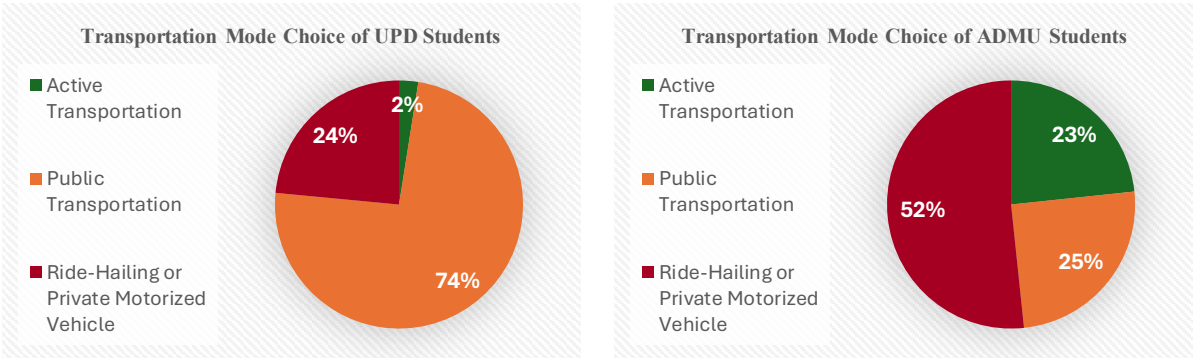

Figure 2. Distribution of university students' transportation mode choice

Field observations indicate that, in general, UPD provides a favorable environment for active transportation. However, not all respondents reside within walking distance to the university premises. Other factors, such as travel time and age, also contribute to students' actual decisions to use this mode when traveling to and from the UPD campus. The same applies to ADMU. Beyond the preferred mode choice of most of the university students, the model developed for UPD and ADMU has different significant predictors (see Table 13). The university student choice model for UPD consists of cost, travel time, travel distance, exercise, days on campus, family income, type of residence, and age. On the other hand, the university student mode choice model for ADMU consists of cost, travel time, travel distance, and environmental awareness.

Table 13. Mode choice and predictors of university students from UPD and ADMU

FACTORS	UPD (public univ)	ADMU (private univ)
Cost	✓	✓
Travel Time	✓	✓

FACTORS	UPD (public univ)	ADMU (private univ)
Travel Distance		✓
Exercise	✓	
Days on Campus	✓	
Family Income	✓	
Type of Residence	✓	
Age	✓	
Environmental Awareness		✓
Most Important Factor	Travel Time	Travel Time
Least Important Factor	Environmental Impact	Environmental Impact

Table 13 shows that travel time is perceived as the most important factor by both UPD and ADMU respondents when choosing their mode of transportation to campus. University students often have tight schedules due to classes, assignments, and other academic or extracurricular activities, which push them to select transportation options that minimize commuting time to maximize productivity and ensure punctuality (Adriana et al., 2023). In contrast, environmental impact is considered the least important factor in their mode choice. While environmental knowledge is essential, it does not necessarily translate into pro-environmental behavior (Vicente-Molina et al., 2013).

A solution must be developed to help students reduce their dependence on high-carbon-emission vehicles, such as those used in ride-hailing services and private cars. To identify effective strategies, students who currently rely on these vehicles were surveyed about the attributes that would motivate them to shift to more sustainable transportation modes. These attributes are presented in Table 14.

Table 14. Willingness of university students to switch from high-carbon-emission modes to more sustainable modes

ATTRIBUTES	GENERAL WEIGHT	
	UPD (235 max.)	ADMU (155 max.)
If trips are cheaper	218	133
If the infrastructure is adequate	207	145
If it allows transfer to other modes	194	133
If it provides a bigger capacity	190	117
If trips are available anytime	218	145
If it is more accessible	226	145
If it is less likely to get into accidents	205	130
If it emits less carbon	193	120

The respondents who use ride-hailing or private motorized vehicles are willing to shift to more sustainable transport modes if these modes are accessible and available anytime. These attributes are consistent with the most important factors that respondents consider when choosing a mode, which is the travel time. Availability and accessibility are some of the factors that are directly linked to travel time.

5. SUMMARY AND CONCLUSIONS

Climate change has become increasingly evident in the Philippines, with rising carbon emissions, particularly from the transportation sector, being a major contributing factor. Universities are a relevant focus in this context since they both generate and attract significant

traffic. This study examines the factors influencing the transportation mode choices of students from UPD and ADMU. These factors included in the study are demographic and socio-economic characteristics, mode-related attributes, and environmental awareness. The relationships were analyzed using MHCM to develop separate mode choice models for UPD and ADMU.

The findings reveal that environmental awareness significantly increases the likelihood of ADMU students in choosing active transportation modes. In contrast, environmental awareness does not influence UPD students' mode choices, who prioritize other factors over environmental impact. Therefore, the null hypothesis is rejected for ADMU students but verified for UPD students. The study also shows that age and enrollment in degree programs related to environmental studies influence environmental awareness among UPD students. However, no demographic or socio-economic characteristics significantly affect environmental awareness among ADMU students.

The MHCM results indicate that the primary factors driving mode choice among UPD students are cost, travel time, travel distance, physical activity (exercise), days spent on campus, family income, type of residence, and age. For ADMU students, the key factors are cost, travel time, travel distance, and environmental awareness. Both models demonstrate good fit, with McFadden pseudo-R-squared values of 0.489 for UPD and 0.420 for ADMU. In terms of modal share, UPD students predominantly rely on public transportation. On the other hand, ADMU students are more dependent on ride-hailing services and private motorized vehicles. Across both universities, travel time is the most influential factor in mode choice, while environmental impact ranks the lowest. Also, the students who use ride-hailing or private motorized vehicles are willing to shift to more sustainable transport modes, given that these modes have higher availability and accessibility—factors that affect travel time.

Given the small number of respondents from ADMU, no definitive conclusions can be drawn when comparing the two universities. The comparison is therefore limited to the scope of the current study. Nevertheless, the findings provide a strong basis for formulating hypotheses for broader future research.

5. RECOMMENDATIONS

The UPD and ADMU can further improve campus connectivity by constructing more pathways, enhancing roads for active transport, and promoting sustainable transportation. The Quezon City government, on the other hand, can continue to improve road infrastructure, increase public transport availability, and ensure fare affordability while supporting active transportation facilities. Future studies can examine factors like comfort, accessibility, and safety, as well as the gap between environmental awareness and sustainable transport choices.

The limited sample size of participants prevents the study from drawing statistically significant conclusions or generalizing the findings to a broader population. It is therefore recommended that future studies use larger sample sizes to validate or refute the results of the current study.

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