Afro-Asian Journal of Scientific Research (AAJSR)
المجلة الأفروآسيوية للبحث العلمي
E-ISSN: 2959-6505
Volume 3, Issue 4, 2025
Page No: 168-174
Website: https://aajsr.com/index.php/aajsr/index
SJIFactor 2024: 5.028 ISI 2025: 0.915 معامل التأثير العربي (AIF) 2025: 0.76

Campus Travel Choices and Green Travel Potential Among the Students at Tripoli University

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خيارات التنقل المتاحة وإمكانية استخدام النقل الحضري للطلاب في جامعة طرابلس

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Received: September 19, 2025 | Accepted: December 03, 2025 | Published: December 17, 2025

Abstract:
This study aims to discover the preferred modes of transportation among University of Tripoli students and evaluate their willingness to shift toward non-motorized alternatives, such as walking and biking. A questionnaire survey of students (undergraduate and postgraduate students) is conducted to gather information for the study. Two questionnaires were used as instruments to gauge the transport mode choice and willingness to use non-motorized travel. The outcome of the study reveals that the most preferred mode of transport is private car (mode choice=30.7%), followed by bus (mode choice = 34.1%) and carpool (mode choice=13.3%). It was concluded that the factors significantly influencing the shift from private car owners to public transportation are reduced travel time and cost, the elimination of parking fees, shorter wait times at bus stations, and improved services at bus stops. By improving these factors, a high proportion of students will opt for public transportation. Currently, cycling is an uncommon option on campus due to weather conditions, but it seems to be generating positive interest among those surveyed. Therefore, to promote this mode of transport, incentives such as bike loans and good facilities should be offered. The suggestion to provide e-bikes also received strong support. The most frequent problem when walking on campus is the lack of covered sidewalks, especially when travelling between areas. This could be the main reason for the university community to rely on public transportation (e.g., campus bus) or a personal automobile (e.g., private car or motorcycle) for longer distances. It was found that the most common challenges for bus rides are timeliness and comfort-related concerns, as they often have to board the bus even when it is already full or wait for the next one, which usually takes longer and increases the number of passengers waiting.

Keywords: Green Transportation, Students, Transport Mode.

الملخص:
تهدف هذه الدراسة إلى تحقيق وسيلة النقل مفضلة لطلاب جامعة طرابلس واستعدادهم للتحول إلى وسائل نقل غير آلية مثل المشي وركوب الدراجات. ركزت هذه الدراسة على استبيانات للطلاب (طلاب البكالوريوس والدراسات العليا). تتضمن هذه الدراسة إعداد استبيانين تم استخدامهما كأدوات لقياس اختيار وسيلة النقل والرغبة في استخدام السفر غير الآلي. تكشف هذه الدراسة أيضًا أن وسيلة النقل الأكثر تفضيلًا هي السيارة الخاصة (اختيار الوسيلة = 30.7٪) تليها الحافلة (اختيار الوسيلة = 34.1٪) ومشاركة السيارات (اختيار الوسيلة = 13.3٪). وخلصت إلى أن العوامل التي تلعب دورًا مهمًا في تحويل أصحاب السيارات الخاصة إلى وسائل النقل العام هي تقليل وقت التنقل وخفض تكلفة التنقل وفرض رسوم على أماكن وقوف السيارات وتقليل وقت الانتظار في محطة الحافلات وتحسين خدمات محطة الحافلات. من خلال تحسين هذه

العوامل، ستتحول نسب عالية من الطلاب إلى وسائل النقل العام. كان ركوب الدراجات خيارًا نادرًا في الحرم الجامعي حاليًا بسبب عامل الطقس، ولكن يبدو أنه يحظى باهتمام إيجابي من المستجيبين. لذلك، لتعزيز هذا النوع من الوسائل، يجب تقديم حوافز مثل قرض الدراجات والمرافق الجيدة. كما تلقى اقتراح توفير الدراجات الكهربائية دعمًا كبيرًا من المستجيبين. كشفت الدراسة ان المشكلة الأكثر شيوعًا أثناء المشي في الحرم الجامعي هي عدم وجود ممر مغطى إلى الوجهة خاصة عند التنقل من كلية إلى أخرى. وهذا أحد أسباب تفضيل مجتمع الحرم الجامعي لاستخدام إما حافلة الحرم الجامعي أو السيارة الخاصة لمسافات طويلة. بالنسبة لمستخدمي الحافلات، كانت المشاكل الأكثر شيوعًا هي دقة جدول الحافلات ومستوى الراحة المنخفض حيث غالبًا ما يضطرون إما إلى ركوب الحافلة حتى لو كانت مكتظة بالفعل أو يتعين عليهم انتظار حافلة أخرى للجلسة التالية والتي تستغرق عادةً وقتًا أطول مما يجعل عدد المستخدمين المنتظرين يميل إلى الزيادة.

الكلمات المفتاحية: النقل الحضري، الطلاب، وسائل النقل.

Introduction:

In recent years, the emission gases produced by motor vehicles have increased and became constitute major threat to the environment Agarana, Bishop, & Agboola, 2017. Society resorts to using motor-transportation methods such as cars and motorcycles in the first place due to their speed of access and mobility the thing which leads to an increase in the number of motor transport vehicles every year. However, this increment has many side impacts on the long term or on the short term in some cases, especially in the small areas such as university campus Zhang, Craft, & Zhang, 2017. In view of the size of the university campus the travel by motor transportation modes can cause several issues, such as environmental and health issues.

Tripoli University campus has been designed to accommodate as many vehicles as possible, which are used by staff, lecturers, and students (including Master's and PhD students). However, the overflow of vehicles nowadays is increasing year over year at Tripoli University campus due to the dispensing of green-transportation methods (bus, bicycles and pedestrian) from most of the undergraduate students and the full dependence on private vehicles, the thing that leads to the traffic congestion at Tripoli University campus. The traffic congestion at Tripoli University campus can be referred to many factors, such as the road system design, road management or the overflow of vehicles, which is the most effective factor, where this factor will be assessed during this research. Traffic congestion issues that occur in the Tripoli University campus impact on several sides, such as the lack of providing green transportation methods, which may lead to a future issue of air pollution, where the traffic congestion will increase and the emission of harmful gases will increase too.

The main aim of the current work is to find an alternative mode of transportation at Tripoli University campus, which can be more environmentally friendly and acceptable among students than the current mode of transportation. The objectives of the study are the following:

- To develop transportation mode-choice models for predicting student travel to and from campus.
- To investigate students' preferred transportation modes and assess their willingness to use non-motorized options on campus.

Travel Behaviour at Kent State University, United State of America:

Most of the Kent State population is students, who form the largest group of the population. The previous research that has been done showed that each additional student registered increases the daily traffic by 0.4 automobiles along the Summit Street. In April 2008, a web survey was distributed evenly through class, although graduate students were Incomplete. The survey involved 668 respondent students, while a pilot test of the questionnaire items was conducted with a sample of students over a designated timeframe to verify their clarity and effectiveness. The survey was provided only once for each student, with no ability to be included multiple times, where the involved student used his/ her own academic email Kaplan, 2015.

The department by age was considered, while females predominated in the survey. In terms of encasement, they accounted for two-thirds of the respondents, representing approximately 60% of the Kent State University student population. This was utilized by an emphasis class consisting of 12 students. The participants could give an additional range to the survey questions themselves Kaplan, 2015.

Kent State University is mainly a residential university; however, it attracts most of the students from a 100-mile radius surrounding. A high number (around 45%) of selected students stay in residence halls, and there were about one out of seven who live with their parents in Kent or in a surrounding town. The rest of the students stay in apartments in the Kent area, and some of them, who are approximately over one-third, stay outside of the Kent area, where those students live around 6 to 15 miles from the university, are excluded from the survey. Table 1 displays the survey results, where students were asked about the transportation methods they employed during various periods, and which transportation method was their main form. Another survey on the last day students leave for the

school, Páez & Whalen, 2010 or how frequently they select a specific transportation method throughout the year, Delmelle & Delmelle, 2012.

Students were permitted to announce their method selection in a general way in this survey. Automobiles ranked first as a mode of transportation, being used by 60% of all students. Students who walked, used the bus, carpooled, or biked together represented the second most common category of transportation. On the other hand, many students reported using the bus occasionally, and nearly 50% of students walk during certain periods Kaplan, 2015.

Table (1): Chosen transportation method to class.

Main Mode	bus	SOV	Passenger	Walk	Bike	Total Responses
Residence Hall	10%	37%	10%	42%	1%	293
Kent	11%	54%	7%	23%	4%	166
Outside Kent	4%	90%	3%	4%	0%	199
Total	9%	57%	7%	26%	2%	658
Mode	**bus**	**SOV**	**Passenger**	**Walk**	**Bike**	**Total Responses**
Residence Hall	52%	49%	23%	67%	6%	293
Kent	34%	69%	30%	52%	13%	166
Outside Kent	19%	95%	10%	17%	1%	199
Total	37%	68%	20%	48%	6%	658

Significance of the study:

According to Anthopoulos et al (2012), sustainable transportation is one of the major problems for most organizations in the twenty-first century. Furthermore, recognize that sustainability is the key issue for universities around the world. The modern campus of Tripoli University is presently following the action to be a sustainable campus in Libya by using sustainable action methods and construction materials, where the students can recognize the methods and regulations to use green transportation easily as they walk on the campus due to the clarity of the pathway for pedestrians and cycling path. However, students may be unaware of the proper use of these methods and regulations, so this study will help to clarify and understand the travel behaviour of students in Tripoli University and inculcate green travel among them. It will also help on the environmental side in the Tripoli University campus by reducing the motor-transportation methods, which have several side impacts on the University campus and human health, as well as environmental impacts.

The present study is focused on a questionnaire survey of students (undergraduate and postgraduate students). This study will include the setting up of two questionnaires, which will be used as instruments to gauge the transport mode choice and willingness to use non-motorized travel. Questionnaire data will be analyzed by using statistical analytical methods such as multinomial probit modelling, regression analysis and correlation test, all of which will be employed in data analysis.

Theory and Calculation:

Scientific research methodology is the scientific process used to collect and analyze information and data, with the aim of arriving at expected or unexpected results based on the study's observations. Careful study planning and a well-defined research methodology are essential for providing a framework for achieving the study's objective and scope. Furthermore, this topic should be discussed in detail, considering the research steps and procedures, from data collection methods to data processing and analysis, to determine the study's objective and scope.

This document details the methodology used to conduct the research in accordance with the study's objectives. This includes a literature review and the development of a questionnaire to assess the information needed for the research.

Data Collection:

In this study, the primary data collection will take place based on a questionnaire, according to Johnson & Christensen 2008, a questionnaire is a self- report data-collection instrument used academically in quantitative studies. Researchers use questionnaire to obtain information about the thoughts, feelings, attitude, beliefs, values, perception, personality and behavioural attention of research participants. Secondary data obtained from local governmental reports in addition to scientific

articles, books, students" thesis and any related academic literature. All these resources will be used to support this research.

This research employed 214 questionnaires administered to students at the University of Tripoli. The data collected during the study were obtained through a combined-method approach, comprising self-administered surveys and email correspondence.

Data Collection Methodology:

An online questionnaire is considered a scientific method for data collection. The questionnaire is developed using a scientific and methodical approach to ensure that all research objectives are addressed and to facilitate the identification of potential recommendations for addressing the problems outlined in the study. The questionnaire serves as a data collection tool containing various types of questions and statements.

Regression Analysis:

Regression analysis is a widely used quantitative research method for modelling and examining relationships between a dependent variable and multiple independent variables. Fundamentally, regression analysis is used to determine the nature and extent of these relationships. In this study, the respondents' data will be analyzed through regression analysis methodology using SPSS software to determine the relationship between the independent variable (number of respondents) and the dependent variable (mode of transportation).

Multinomial Probit Modelling:

The multinomial probit model is primarily applied in statistics and econometrics, is a generalization of the probit model applied when the dependent variable can assume multiple categorical outcomes. As a result, it serves as an alternative to the multinomial logit model for multiclass classification. In this paper, multinomial probit modelling is applied to the responses of the study related to the first and second objectives to generate reliable data addressing the study questions.

Reliability Test:

A reliability test is considered to assess the reliability and consistency of the collected data. In other words, it evaluates whether the questionnaire produces reliable and accurate results, ensuring that conclusions drawn from the data are valid. Therefore, a study conducted by Raykov, Tenko, 1997 used Cronbach's alpha coefficient to assess the research's reliability. Table 2 presents the Cronbach's Alpha Coefficient obtained from the study, which indicates the reliability levels of the variables.

Table (2): Extracted Cronbach's Alpha Coefficients from the study conducted by Raykov, Tenko, 1997.

Alpha Coefficient Range, α	Level of Reliability
0.80 to 0.95	Very good Reliability
0.70 to 0.80	Good Reliability
0.60 to 0.70	Fair Reliability
α < 0.60	Poor Reliability

Results and discussion:

Reliability Measurement:

Reliability Testing: Cronbach's Alpha is employed to assess how consistently the items in a questionnaire measure the intended construct, and its value lies between 0 to 1. When the value of alpha approaches close to one indicates greater internal consistency among the items in the questionnaire. The extracted results were interpreted and concluded using the scale obtained from Table 2. The questionnaire consists of a total of 40 items, including 12 Likert-scale variables used for testing. Therefore, the number of items "N" shown in Table 3 shows Cronbach's Alpha test is 12. In order to evaluate the reliability of the questionnaire items in this study, Cronbach's Alpha test was performed. The results shown in Table 3 indicate an overall alpha value of 0.709, reflecting good reliability for the initial 40 responses, consistent with the criteria of Zikmund et al. 2010.

Table (3): Reliability Statistics obtained from the items in the questionnaire.

Cronbach's Alpha	N of Items
0.709	12

Correlation Test:

Correlation analysis quantifies the degree of association between two continuous variables. Correlation measures the strength and direction of the association between two continuous variables, where the two variables should have a normal relationship. Correlation is expressed using the symbol

(r). The value of correlation (r) always lies between -1 and +1. Table 4illustrates the results of the correlation analysis for variables including transportation, residence area, age, and level of study.

Table (4): Correlation analysis Correlations

		Transportation	Residence	Age	Comfortable	Level_of_Study	Monthly_Income
Transportation	Pearson Correlation	1	-0.216**	-0.046	-0.194*	-0.159	0.047
	Sig. (2-tailed)		0.008	0.575	0.017	0.052	0.567
	N	150	150	150	150	150	150
Residence	Pearson Correlation	0-.216** 0.008	1	0.038	0.244** 0.003	0.025	0.020
	Sig. (2-tailed)			0.647		0.765	0.808
	N	150	150	150	150	150	150
Age	Pearson Correlation	-0.046	0.038	1	0.093	0.718**	0.271**
	Sig. (2-tailed)			150		0.000	0.001
	N	0.575 150	0.647 150		0.259 150	150	150
Comfortable	Pearson Correlation	-0.194* 0.017	0.244**	0.093	1	0.126	0.188*
	Sig. (2-tailed)		0.003	0.259		0.125	0.021
	N	150	150	150	150	150	150
Level_of_ Study	Pearson Correlation	-0.159	0.025	0.718**	0.126	1	0.139
	Sig. (2-tailed)			0.000			0.090
	N	0.052 150	0.765 150	150	0.125 150	150	150
Monthly_ Income	Pearson Correlation		0.020	0.271**	0.188* 0.021	0.139	1
	Sig. (2-tailed)	0.047 .567	0.808	0.001		0.090	
	N	150	150	150	150	150	150

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

From the above Table 4correlation matrix, “transportation mode” has a significant correlation with place of residence and comfort. Further, it is poorly correlated with the age of respondents and their monthly income. “Residence” has a significant correlation with comfort and transportation mode. Further, it is poorly correlated with age, level of study and monthly income. “Age” has a significant correlation with the level of study and is moderately correlated with monthly income. Further, it is poorly correlated with transportation and residence.

Regression Test:

Regression analysis is a statistical method used to quantify the average relationship between two or more variables, expressed in the original units of the data. Regression analysis helps to establish the direction and strength of cause-and-effect relationships among variables. In regression analysis, the variable representing the cause is treated as the independent variable, while the variable representing the effect is considered the dependent variable. The findings of the data analysis are detailed in this paper, where regression analysis is employed to assess the relationship between the dependent and independent variables. The analysis indicates that transportation is influenced by both monthly income and travel distance. Some of the regression test results are shown in Tables 5 and 6 below.

Table (5): Regression Analysis for model analysis

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate
1	0.687	0.472	0.464	1.38470

Table (6): ANOVA-Placements

Model	Sum of Squares	df	Mean Square	F	Sig
Regression	251.585	2	125.792	65.606	0.000
Residual	281.855	147	1.917		
Total	533.440	149			

Table 5 presents the regression results, summarizing the model's performance along with the relevant analysis. The coefficient R indicates the multiple correlation, with possible values from -1 to +1. The R value of 0.687 indicates a positive association between transportation and the variables monthly income and distance. The value of R^2, which represents the coefficient of determination, lies within the range of 0 to 1. The R^2 value of 0.472 indicates that distance and monthly income account for 47% of the variation in transportation. Also, the ANOVA results represented in Table 6 show a significant F value (significant value is less than 0.05), indicating that the dependent variable, transportation, is reliably predicted by the model.

Conclusions:

This study focused on a questionnaire survey of students (undergraduate and postgraduate students). This study includes the setting up of two questionnaires, which were used as instruments to gauge the transport mode choice and willingness to use non-motorized travel. Questionnaires have been analyzed by using statistical analytical methods such as multinomial probit modelling, regression analysis and correlation test, all of which were employed in data analysis.

The main aim of this paper is to find an alternative mode of transportation at Tripoli University campus which can be more environmentally friendly and acceptable among students than the current mode of transportation. To achieve the goal of this study, there are two objectives that have been achieved. The first objective has been successfully achieved by the developed transport mode choice models for predicting campus travel by students.

This research employed 150 questionnaires administered to students at the University of Tripoli. Data were collected using a combination of methods: self-administered surveys and email. In this study, nominal and ordinal data were collected through the questionnaires. Nominal scales are used to label variables without a quantitative value. An example of nominal data is information about the participants' backgrounds, such as gender. The quantitative data obtained will be statistically analyzed.

In this study, the quantitative data were analyzed using SPSS (Statistical Package for the Social Sciences), a widely recognized and commonly used statistical software in the field of education. The methodological approach is primarily based on frequency distribution, a fundamental technique for describing data by organizing values hierarchically and indicating the frequency of each unique value. The study of transportation choice began with the distribution of two questionnaires focusing on two main objectives: transportation mode choice and willingness to use non-motorized transportation. The questionnaire was distributed online via Google and administered to 150 university students at various levels. SPSS software was used for further analysis of the results.

SPSS was selected due to its widespread use in both academic and business settings, making it the most commonly utilized software of its kind. Additionally, SPSS is a versatile package that supports a variety of analyses, data transformations, and output formats. As a result, statistical methods have been designed to help researchers organize and interpret raw data, providing a means to summarize information efficiently and effectively.

An overall reliability score of 0.75 was obtained from the test, demonstrating good reliability for the initial 40 questionnaire responses, as suggested by Raykov, Tenko. On the other hand, after collecting and generating the data, the researcher found that these three factors have a moderate influence on the mode choice of transport. Among the factors, level of study (correlation=0.718) has the highest influence, followed by monthly income (correlation=0.271), and lastly is age (correlation=0.244). The significance of these three factors is 0.000.

The study also reveals that the most preferred mode of transport is private car (mode choice=30.7%) followed by bus (mode choice=34.1%) and carpool (mode choice=13.3%). It was concluded that significant determinants for encouraging private car users to shift to public transport are lower travel time and cost, parking fees, reduced waiting times at bus stops, and enhanced bus stop facilities. Enhancing these aspects could result in a higher proportion of students using public transportation.

Transportation planning should incentivize the use of alternative modes of transport and discourage single-occupant vehicles. Currently, cycling is an uncommon option on campus due to weather conditions, but it appears to be generating interest among respondents. Therefore, to encourage the use of this mode of transport, incentives such as bicycle loans and improved facilities should be provided. The proposal to introduce electric bicycles also received considerable support.

The most frequent problem when walking around campus is the lack of covered walkways, especially when moving between areas. This is one of the factors explaining why members of the university community prefer using the campus bus or private vehicles for longer distances. For those who do use the bus, the most common problems are punctuality and discomfort, as they often have to board the bus even when it is already full or wait for the next one, which usually takes longer and increases the number of people waiting.

The study suggests that improving specific positive aspects, such as travel time, travel cost, and service quality, is critical for encouraging a shift from private to public transportation, thereby supporting sustainability. Despite its contributions, the study faced certain limitations. Challenges included low cooperation from respondents and a limited response rate from guardians. Furthermore, the research relied on a small sample relative to the overall target population. Expanding the sample size and study area, along with employing innovative strategies to encourage survey participation, could enhance future research. Further, the model created in this project is based on the basic multinomial logit, and it can be improved by studying other kinds of models, such as mixed logit models, which have more flexible error structures.

Recommendations for Further Research:

For future work, it is recommended to implement a universal transport system that addresses the needs of all users, including those with disabilities, by providing pedestrian-friendly services and physically separating pedestrians from motorized vehicles via bridges, crosswalks, and appropriate signage. A protective system is required to address issues such as poor lighting, inadequate drainage, and potential encounters with wild animals, thereby encouraging greater use of public transportation.

Future research should examine the universality of the types and number of latent variables and assess their influence on mode choice behavior. In addition, greater efforts should be made to collect questionnaire data via social networking services to minimize potential biases. Additionally, data were collected via an online survey, which excluded individuals with disabilities who lack computer access. Consequently, the sample for this study may have been biased due to the survey methodology. Furthermore, the research employed a descriptive design, limiting the ability to draw conclusions about predictive or causal relationships among variables.

In terms of green transportation modes, it is possible to encourage car users to switch to public transport. Future research should explore strategies to encourage individuals to shift their preferred mode of travel by investigating the types of public transport that best meet their needs. This will increase the willingness of foreign students to use greener transportation modes. Future research should examine additional factors that may influence this behaviour.

In-depth interviews and brainstorming sessions with a larger number of participants could contribute to obtaining more relevant satisfaction measurements. The approach proposed in this document will be useful for researchers and scientists working in similar areas and for those starting out in this field.
The insights obtained from the pilot survey, particularly regarding sample distribution and income group classification, are likely to contribute to research in transport planning surveys. Lastly, conducting a pilot survey to test data collection methods and instrument design is recommended, as a well-designed survey ensures higher-quality data and more robust research outcomes.

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