ASSESSING THE UNIVERSITY ON-CAMPUS TRANSPORT MODES: A PRELIMINARY STUDY

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Keywords
Sustainable travel
Questionnaire
On-campus transport modes

Abstract

Transportation management on a university campus is critical to enable the efficient movement of students, faculty members, staff, and visitors as to minimize traffic congestion, environmental impact, and parking issues. The choice of on-campus transport mode can vary based on the campus's size, location, and available infrastructure. In this study, a questionnaire is introduced to assess the factors that may affect on-campus transport mode choice of students. A group of 60 undergraduate students who must travel to one of the furthest locations from the entrance gates of a campus is considered. The convenience of on-campus roads and the distance of the accommodation to the campus are examined. The results illustrated that weather conditions and air temperature were the critical factors for the transport mode choice, specifically for cycling and walking. The most preferred on-campus transport mode was determined as the ring line, especially during exam periods. Walking was only preferred if the student resides close to the campus. Both genders stated that the bicycle roads were narrow. This preliminary study has a potential to be applied for larger group of participants and is expected to inspire decisionmakers of the universities to improve the infrastructure of the university campus and help to develop cost efficient and sustainable travel options.

KAMPÜS İÇİ ULAŞIM ALTERNATİFLERİNİN DEĞERLENDİRİLMESİ: BİR ÖN ÇALIŞMA

Anahtar Kelimeler
Sürdürülebilir ulaşım
Anket
Kampüs içi ulaşım

Öz

Üniversite kampüsündeki ulaşım yönetimi, trafik sıkışıklığı, çevresel etki ve park sorunlarını en aza indirecek şekilde öğrencilerin, öğretim üyelerinin, personelin ve ziyaretçilerin etkin bir şekilde hareketini sağlamak için kritik bir öneme sahiptir. Kampüs içi ulaşım alternatifinin seçimi, kampüs büyüklüğü, konumu ve mevcut altyapı özelliklerine göre değişebilir. Bu çalışmada, öğrencilerin kampüs içi ulaşım tercihini etkileyebilecek faktörleri değerlendirmek üzere bir anket önerilmiştir. Çalışma, kampüs giriş kapılarından en uzak mesafelerden birine seyahat etmesi gereken 60 lisans öğrencisinden oluşan bir grup ile gerçekleştirilmiştir. Kampüs içi yolların uygun olup olmadığı ve konaklamanın kampüse uzaklığı incelenmiştir. Sonuçlar, ulaşım alternatifi seçiminde, özellikle bisiklete binme ve yürüme için, hava koşullarının ve hava sıcaklığının kritik faktörler olduğunu göstermiştir. Özellikle sınav dönemlerinde en çok tercih edilen kampüs içi ulaşım şekli ring hattı olarak belirlenmiştir. Yürümenin sadece öğrenci kampüse yakın ikamet etmesi durumunda tercih edildiği belirlenmiştir. Her iki cinsiyet de bisiklet yollarının dar olduğunu belirtmektedir. Bu ön çalışma, daha geniş bir katılımcı grubu için uygulanma potansiyeline sahiptir. Çalışmanın üniversite karar vericilerine kampüs altyapısını iyileştirme konusunda ilham vermesi ve uygun maliyetli ve sürdürülebilir ulaşım seçeneklerinin geliştirilmesine yardımcı olması beklenmektedir.

Araştırma Makalesi — Research Article
Başvuru Tarihi : 13.03.2023 — Submission Date : 13.03.2023
Kabul Tarihi : 18.03.2024 — Accepted Date : 18.03.2024

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https://doi.org/10.31796/ogummf.1263319

1. Introduction

On-campus travel modes refer to the various transportation alternatives that individuals use to move around a college or university campus. In addition to environmental considerations, personal preferences, and specific campus policies and regulations may influence how individuals choose to get around on campus.

The number universities that focus on providing convenient and sustainable transportation options to support their students' needs are increasing. Transportation options, transportation planning, and issues related to infrastructure are considered and this study aims to address the following research questions for the course and exam periods:

To examine the difference for the factors effecting the transport mode choice based on gender,

To examine the difference for the convenience of on-campus roads and paths based on gender,

To examine the difference for the choice of on-campus travel mode based on the distance of the accommodation to the campus,

To assess the possible relationship between the choice of transport mode and factors for the choice.

First, a literature review is conducted to identify the existing questionnaires and scales that can be related to the research objectives. Then, a theoretical framework is developed to outline the variables. The pilot testing is conducted on a small sample of participants. The feedback and insights from the participants confirmed that there is no problem for the question wording, response options, or question sequencing. The questions are designed as to ensure content validity and are related to the research objectives. The data is collected by use of an online questionnaire that includes 20 questions. The students who volunteered to participate this study completed the questionnaire during April and May 2022. After data analysis, response distributions, correlations, and other related statistics are examined. Findings, research limitations, and feedback to improve the questionnaire and the study are summarized.

The study is structured as flows. The up-to data accessible literature related with the to-campus and on-campus transportation modes are summarized in the second section. In the method section, details of the study area, current transport modes, and the information for the questionnaire is given. Statistical analysis is provided in the fourth section and the results are discussed in the following section. Final section concludes the study and provide suggestions for the future studies.

2. Literature Review

There are several studies in the literature considering university campus and on-campus transportation. The most recent papers on this topic are summarized in this section.

Wilson, Vairo, Bopp, Sims, Dutt, and Pinkos (2018) examines 17 universities in United States to increase student and staff active commuting on cycling. Hasan, Abbas, Kwayu, and Oh (2019) identifies the sociocultural, environmental, and transportation factors for walking and cycling to and from the university in Iraq. Since, it is not common in the society, females have reported that they feel embarrassed when walking and cycling. On the other hand, males don't prefer because of their age and social status in the society. Gocer and Gocer (2019) evaluates the transportation alternatives to a private university campus in Istanbul. Duration of travel for the students and staff to the campus is examined by considering the capacity and fuel consumption. The survey also included questions to obtain opinion of students and staff on-campus layout and open space. Capasso da Silva and Rodrigues da Silva (2020) aim to identify how violence-related aspects influenced transport mode choice on trips to the Sao Carlos campus of the University of Sao Paulo, Brasil. The online survey results confirmed that the crimes had occurred on weeknights and women felt unsafe more than men.

Hamad, Htun, and Obaid (2021) focuses on the transportation to a university campus in United Arab Emirates. Students, academic and administrative staff, visitors were defined as a group, and data on the mode of transportation, distance and duration of transportation were compiled with the help of a survey. Among the factors affecting sustainable transportation alternatives in the short and long term, the importance of options such as walking and bicycle use is emphasized. Rerat (2021) considers the staff and students in a university in Switzerland to assess the transportation problem to the campus. The effect of age, gender, income level, travel distance on transportation preference is examined. Results suggest that the number and capacities of public transportation vehicles should be arranged considering the start times of the courses. Also, supporting car-sharing and promoting cycling and walking instead of using two-wheeled motor vehicles. Crist et al. (2021) studies the active commute mode, transport physical activity, and intention to use light rail transit at The University of California in San Diego, USA. Results state that staff are less likely to actively commute, compared to faculty or students and older age is associated with decreased odds of active commuting. Sgarraa, Metaa, Saporitob, Persiaa, and Usami (2022) applies a survey with students and personnel to identify perception and attitude for different modes of transportation to improve the mobility around the

university campuses. Results favor the increase in the use of bicycles and minimizing the vehicles with high emission values.

Adenle, Chan, Sun, and Chau (2021) assess and prioritizes the sustainable and healthy campus design and sustainability factors in Nigeria. Balseroa, Lamartya, and Monzóna (2021) aims to attract attention to the environmental pollution in Madrid, Spain. Therefore, a survey is applied to the students and personnel of six universities to gather data of socioeconomic level, mobility models, and effect of Covid-19. It is proven that the mobility has decreased between 2018-2021 due to Covid-19. Increasing the number of ring lines in the campuses and limiting the number of private vehicles is suggested to increase mobility.

Cadena, Andradeb, Meirac, and Douradod (2020) investigate the mobility act in Brasil, attract attention to the sustainable in and on campus travel, and importance of bicycle use. Ridhosari and Rahman (2020) evaluates the carbon footprint and emission sources based on a university in Indonesia. Data related to transportation (mode of transportation, distance travelled, and emission per km) is gathered by a survey. Eccarius, Leung, Shen, Burke, and Lu (2021) studies the use of electric supported bicycles (pedelec, e-bike) for university campuses in different locations and concludes that the university students can adopt shared e-bikes. Sun and Duan (2021) point the low service quality as the main reason for the failed campus bike-sharing practice in a university campus in China.

Sanders, Branion-Calles, and Nelson (2020) applies a survey to students and personnel of Arizona State University. The questions are constituted as safety requirements, advantages, disadvantages, age, gender, and travel types of the users. Statistical analysis results attract attention to improving the e-scooter safety, tracking the maintenance, and supporting e-scooter use to decrease the emission. Sanders, da Silva Brum-Bastos, and Nelson (2022) states that use of e-scooter may reduce physical active travel but healthier than driving.

Taylor and Mitra (2021) focus on the commute satisfaction of students to the campus and evaluate the attendance to the classes and academic success. In another novel study, Bai, Cao, Wang, Liu, and Wang (2022) confirm that the street greenery and the active travel behavior of students on closed university campuses in China is positively associated.

Based on the accessible literature, it can be stated that surveys are designed and utilized to take the view of personnel, staff, or students in the university to evaluate the access to the campus or on-campus travel. These studies mainly focus on various issues to encourage walking, cycling, to enable safe on-campus travel, to minimize fuel consumption for sustainable travel, or to identify the most convenient travel mode. However, there is currently no questionnaire to cover all related issues for the on-campus travel and obtain the perception of individuals on the campus.

This study aims to define and identify possible factors that may affect students' choice for on-campus transport modes, assess the convenience of roads and paths on the campus, and evaluate the effect of the travel distance to the campus.

3. Method

An online questionnaire is designed for the purpose of this study to attract attention to the factors that influence students' travel the modes of commuting. An institutional approval of the study protocol (E-81922757-199-329687) was obtained from Eskisehir Osmangazi University Science and Engineering Ethical Commission. Written permission was obtained from university. Research and publication ethics are strictly followed in this study. Informed consent was obtained from all participants before the study. 60 undergraduate Industrial Engineering students from ESOGU Faculty of Engineering and Architecture answered the 20 questions in the questionnaire that took about 5 min during April and May 2022.

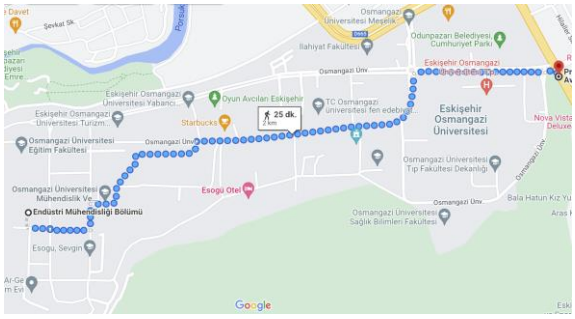
3.1. Study Area

This research investigates commuting behavior of students travelling to Eskisehir Osmangazi University (ESOGU), located in Eskisehir, Turkey. The summers are warm, dry, and clear and the winters are very cold, snowy, and partly cloudy in Eskisehir. During May and October average temperatures fall between 20 and 26 °C. The coldest month is January, with an average high-temperature of 3.8°C and an average low-temperature of -3.7°C. November, December, and January are months with snowfall. The weather conditions usually effect the transportation alternatives such as walking and cycling to and from the campus.

ESOGU has five campuses in Eskisehir Province (Meselik, Bademlik, Eskisehir Organized Industrial Site, Ali Numan Kırac) and three campuses in the districts of Eskisehir (Sivrihisar, Mahmudiye, Cifteler).

The buildings of Faculty of Engineering and Architecture, Faculty of Dentistry, Faculty of Education, Faculty of Arts and Sciences, Faculty of Economics and Administrative Sciences, Faculty of Law, Faculty of Theology, Faculty of Art and Design, Faculty of Health Sciences, Faculty of Medicine, Faculty of Tourism, Vocational School of Health Services, Institute of Educational Sciences, Institute of Science, Institute of Health Sciences, Institute of Social Sciences, and Department of Foreign Languages are located in Meselik Campus that is established on an area of approximately 160 hectares.

This study considers the on-campus transportation from and to the area where the Engineering Departments of the Faculty of Engineering and Architecture with three training blocks, Dean's blocks and two separate groups of laboratories are located. Mechanical Engineering, Geological Engineering, Mining Engineering Departments are in M2 Block, Industrial Engineering, Chemical Engineering, Metallurgical and Materials Engineering Departments are in M3 Block, and Computer Engineering, Electrical and Electronics Engineering, and Civil Engineering Departments are in M4 Block (ESOGU, Faculty of Engineering and Architecture, 2022). Two main Gates are represented in Figure 1 that are approximately 2 and 1.7 km away from the faculty in concern.



Gate A

Gate B

Figure 1. Distance Representation Between the Main Gates and the Engineering Faculty

3.2. Transport Modes

Before the 2021-2022 Fall term (Covid-19 pandemics), there were several distinct travel alternatives within the ESOGU Meselik Campus.

Campus Trolley: ESOGU Meselik Campus had a 1200-meter-long train line with a 600 mm rail span that traveled for student and personnel transportation between 2003 and 2006. The locomotives and wagons used in the operation date from 1918 and were used on the legendary Baghdad railway. Historical locomotives and wagons, which were one of the most important symbols of transportation by going many kilometers years ago, are a background for various photos of students today. And a few wagons still serve as cafes today.

Bicycle: In 2014, in order to encourage the community to move for a healthy life and to make the bicycle, one of the healthiest and most fun tools of movement, a part of daily life, a Social Responsibility Project was realized. Importance of an active life was emphasized at the same time by providing transportation within the campus with shared bicycles located at the Yellow Bicycle stand. Within the scope of this project, it is stated that more than 1500 students have been reached at ESOGU. However, the project was terminated.

The students can transport on the campus with their own or shared bicycles. The bicycle routes are divided into one lane between the driveway and the pathway.

Public transport: Before the Covid-19 pandemics, ESOGU Meselik Campus was accessible from the city center by tram, municipal buses and minibuses. However, based on the decisions taken, as of 2020, municipal buses are prohibited from entering the Meselik Campus.

After the 2021-2022 Fall semester, due to the restrictions imposed by the pandemic, it is observed that on campus transportation is widely carried out with the use of private vehicles, ring line, and shared vehicles.

Private Vehicle: According to the ESOGU Traffic Directive, students, staff, or faculty members who will enter the places under the administration of the university by private vehicle are required to obtain a Vehicle Entry Card to use parking areas, enable security, and access control.

Ring Line: A shuttle service is provided for students and staff to provide easy access to the faculties in Meselik Campus. The minibus departure from the entrance gate of the Faculty of Medicine (Gate A) and enables on-campus transportation on the predetermined route.

e-Scooter: At the ESOGU Meşelik Campus, it is also possible to benefit from the e-scooter service provided by different brands.

3.3. Data

This preliminary study aims to assess the transport modes in ESOGU Meselik Campus. Among the engineering departments, Industrial Engineering department can be considered as one of the furthest locations to the main entrances of the campus. Therefore, target population is determined as the 500 undergraduate Industrial Engineering students who are enrolled to the program. To represent the population, with 90% level of confidence and 10% error, ideal sample size is calculated as 60. The answers of students who volunteered for the study are considered. The frequency of use of the preferred transport modes (walking, bicycle, motorcycle, car, e-scooter) and the factors that influence their preference is examined.

3.4. Variables

The questionnaire that is developed for this study is given in the Appendix that includes 20 questions. The variables are briefly described in Table 1. Main sociodemographic variables include the age and gender of the participants. The preference of ten transport modes is investigated. The options such as bicycle, e-scooter, motorbike, and car are detailed based on the ownership. Since motor vehicles require certain license, a question is included to determine the license ownership and type. The travel distance and the time interval that is required to travel to the campus during course and exam periods are identified.

Table 1. Variable Descriptions

Variable	Description
Age	17-19 20-22 23-25 26 and above
Gender	Female, Male
Transport modes	Walking, Bicycle (owned), Bicycle (shared), E-scooter (owned), E-Scooter (shared), Motorbike (owned), Motorbike (shared), Car (owned), Car (shared), Minibus (Ring Line)
Motor vehicle license	Does not have a license A1, A2, A, B
Travel distance to the campus	Less than 3 km Between 3-5 km Between 6-10 km Between 11-15 km More than 16 km
Factors that affect choice of transport mode	Easy access, Speed, Cost, Social distancing, Distance to be covered, Air temperature, Weather conditions, Emission values

4. Statistical Analysis

Based on the Female (41.66%), Male (58.33%) students' data, related statistical analysis (ANOVA, t-test, and correlation analysis) are conducted using SPSS. %50 of the participants is aged between 20-22 and %43.3 between 23-25. Students who are older than 26 are %5 and lower than 19 are %1.719. The analysis revealed no significant difference between the age groups therefore not included.

4.1. Analysis of Factors for the Choice of Transport Mode based on Gender

To examine the difference for the factors effecting the transport mode choice based on gender, following hypothesis and alternative hypothesis are defined:

H0: There is no significant difference for transport mode choice factors between genders.

H1: That there is a significant difference for transport mode choice factors between genders.

The hypothesis is separately tested for course and exam periods and the results are summarized in Table 2. During the course periods, the factors such as easy access, travel distance, air temperature, weather conditions, and emission values illustrate a significant difference based on gender. On the other hand, there is no significant difference for the transport model choice for the factors speed, cost, and social distance based on gender.

Table 2. Analysis of Factors for the Choice of Transport mode based on Gender

Course Periods						
Variables	Groups	$\bar{X}$	SS	t	sd	p
Easy access	F	4.48	0.510	2.823	48.467	.007
	M	3.83	1.224			
Speed	F	4.32	0.748	1.769	58.000	.082
	M	3.89	1.051			
Cost	F	4.36	0.700	1.545	58.000	.128
	M	3.94	1.211			
Social distance	F	2.88	1.092	1.837	58.000	.071
	M	2.31	1.231			
Travel distance	F	3.80	1.000	2.265	58.000	.027
	M	3.11	1.255			
Air temperature	F	4.20	0.707	3.161	55.639	.003
	M	3.40	1.241			
Weather conditions	F	4.36	0.810	2.485	58.000	.016
	M	3.66	1.235			
Emission value	F	3.28	1.021	2.753	57.331	.008
	M	2.46	1.291			
Exam Periods						
Variables	Groups	$\bar{X}$	SS	t	sd	p
Easy access	F	4.56	0.583	1.515	58.000	.135
	M	4.20	1.079			
Speed	F	4.60	0.577	1.037	57.276	.304
	M	4.40	0.914			
Cost	F	3.68	1.215	0.626	57.366	.534
	M	3.46	1.540			
Social distance	F	2.76	1.200	1.395	58.000	.168
	M	2.29	1.363			
Travel distance	F	3.96	0.889	1.101	57.011	.275
	M	3.63	1.437			
Air temperature	F	3.96	1.098	2.005	57.960	.050
	M	3.29	1.506			
Weather conditions	F	4.12	1.054	2.367	57.783	.021
	M	3.37	1.395			
Emission value	F	3.28	0.980	2.937	57.963	.005
	M	2.37	1.416			

During the exam periods, the factors such as air temperature, weather conditions, emission values illustrate a significant difference based on gender. On the other hand, there is no significant difference for the transport model choice for the factors easy access, speed, cost, social distance, and travel distance based on gender.

4.2. Assessing the Convenience of Road and Paths on-campus based on Gender

The students were asked to assess the driveway (Q.16), bicycle path (Q.17), sidewalks (Q.18) in the questionnaire in separate questions. The answers were structured as to fit five scale; most convenient (i.e., I don't have any problems) to least convenient (i.e., I always have problems).

To examine the difference for the convenience of on-campus roads and paths based on gender, following hypothesis and alternative hypothesis are defined:

H0: There is no significant difference for the convenience of motor vehicle road between genders.

H1: That there is a significant difference for motor vehicle road between genders.

The hypothesis is separately tested for bicycle paths and sidewalks Table 3 illustrates that there is no significant difference for assessing the convenience of road and paths based on gender. Female and male participants have stated that they sometimes have problems due to the crowded driveways. The participants have stated that they sometimes have problems because the bicycle roads are too narrow.

There is a significant difference between genders for the convenience of pathways on-campus. Female state that they sometimes have problems due to the narrow pedestrian ways, on the other hand male participants complain about crowded pathways.

Table 3. Assessment of Road and Paths On-campus based on Gender

Variables	Groups	$\bar{X}$	SS	t	sd	p
Vehicle road	F	2.52	1.418	0.091	58.000	.928
	M	2.49	1.463			
Bicycle road	F	1.84	1.106	-411	58.000	.682
	M	1.97	1.294			
Pathway	F	2.12	1.130	-1.126	56.839	.265
	M	2.49	1.138			

4.3. Correlation Analysis for Transport Mode and Choice Factors

Correlation analysis is conducted to assess the possible relationship between the choice of transport mode and factors for the choice. The course and exam periods are considered separately.

Table 4 summarizes the correlation analysis results for the course period. The results illustrate that there is a weak and positive relationship between easy access, speed, cost, social distance, travel distance, air temperature, and weather conditions for the walking alternative. On the other hand, there is a moderate and positive relationship between walking and emission value.

There is a weak and positive relationship between the easy access, cost, air temperature, and weather conditions for the bicycle (own) and bicycle (shared) transport mode. Also, there is a weak and negative relationship between the speed, social distance, travel distance, and emission value.

The relationship between the minibus (ring line on campus) and the factors affecting transportation preference was examined by correlation test. It is seen that there is a weak and positive relationship between the factors such as easy access, cost, social distance, travel distance, air Temperature, weather condition, and emission value. It is seen that there is a moderate and positive relationship between the minibus preference and the speed factor.

Table 5. summarizes the correlation analysis results for the exam period. The results illustrate that there is a moderate and negative relationship between easy access, speed, and emission values for the walking alternative. On the other hand, there is a weak and positive relationship for the cost and social distance. A weak and negative relationship is identified with the travel distance, air temperature, and weather conditions.

There is a weak and positive relationship between the easy access, speed, cost, social distance, travel distance, air temperature, weather, and emission value with the bicycle (owned). There is a weak and negative relationship between the easy access, speed, air temperature, weather, and emission value factors and shared bicycle mode. It is seen that there is a weak and positive relationship for the cost, social distance, and travel distance.

When the minibus transport mode and the factors affecting the travel preference was examined, it is concluded that the factors easy access, and speed have a moderate and positive relationship, cost, social distance, and air temperature have a weak and negative relationship, travel distance, weather conditions, and emission values have a weak and positive relationship.

Table 4. Correlation Analysis for Travel Factors and Choice of Transport Mode During Course Period

	Easy access	Speed	Cost	Social distance	Travel distance	Air temperature	Weather conditions	Emission value
Walking	.005	.004	.033	.080	.143	.203	.204	.410*
Bicycle (own)	.058	-.10	.029	-.065	-.040	.065	.102	-.039
Bicycle (shared)	-.088	-.085	-.092	.063	.000	-.036	.121	.146
E-Scooter (own)	-.107	-.016	-.025	.269*	.111	.053	.128	.321*
E-Scooter (shared)	-.052	.025	-.003	-.023	.071	-.059	.051	.063
Motorbike (own)	-.199	-.209	-.200	.070	-.063	-.123	.091	.255*
Motorbike (shared)	-.061	-.057	-.029	.067	.037	-.004	.078	.132
Car (own)	-.022	-.010	.039	.020	.056	-.061	.018	.065
Car (shared)	.116	.168	.154	.120	.040	.050	.107	.000
Minibus	.295*	.344*	.213	.079	.275*	.062	.146	.088

*Correlation is significant at the 0.01 level

Table 5. Correlation Analysis for Travel Factors and Choice of Transport Mode During Exam Period

	Easy access	Speed	Cost	Social distance	Travel distance	Air temperature	Weather conditions	Emission value
Walking	-.351*	-.308*	.197	.131	-.057	-.049	-.137	-.046
Bicycle (own)	.059	.020	.235	.114	.180	.107	.121	.055
Bicycle (shared)	-.120	-.173	.121	.018	.005	-.053	-.013	-.023
E-Scooter (own)	-.193	-.246	.042	.052	-.081	-.149	-.069	.025
E-Scooter (shared)	-.239	-.107	-.062	-.049	-.049	-.169	-.163	-.027
Motorbike (own)	-.193	-.246	.042	.052	-.081	-.149	-.069	.025
Motorbike (shared)	-.041	-.091	.189	-.055	.089	-.031	-.016	-.067
Car (own)	-.129	-.142	.183	.202	.043	-.062	.086	.030
Car (shared)	.006	.031	.076	.102	.075	.072	.096	-.061
Minibus	.326*	.409*	-.121	-.182	.073	-.001	.146	.090

*Correlation is significant at the 0.01 level

4.4. Assessing the Choice of Travel Mode and the Travel Distance to the Campus

To examine the difference for the choice of travel mode based on the distance of the accommodation to the campus, following hypothesis and alternative hypothesis are defined:

H0: There is no significant difference for the travel distance between the choice of travel modes.

H1: That there is a significant difference for the travel distance between the choice of travel modes.

The results of Sig. (Test of Homogeneity of Variances) illustrate that some of the values are not homogenous. Since, Sig. (ANOVA) values are larger than 0.05, there is not a significant difference (Table 6). The data for course period and exam period are assessed separately.

Table 6. Assessing the Transport Mode and the Distance to the Campus

	Course Period		**Exam Period**	
Transport mode	Sig. (Test of Homogeneity of Variances)	Sig. (ANOVA)	Sig. (Test of Homogeneity of Variances)	Sig. (ANOVA)
Walking	.005	.774	.805	.962
Bicycle (own)	.006	.248	.076	.693
Bicycle (shared)	.000	.282	.006	.474
E-Scooter (own)	.541	.952	.023	.614
E-Scooter (shared)	.999	.998	.175	.870
Motorbike (own)	.113	.788	.023	.614
Motorbike (shared)	.014	.587	.006	.512
Car (own)	.000	.249	.050	.571
Car (shared)	.006	.426	.049	.655
Minibus	.101	.816	.067	.402

As Post Hoc tests, Games-Howell analysis is applied. Significant difference is identified only for one transport mode (Table 7). The students' preference of walking to the campus is significantly different based on the distance to the campus (F=.447; p<.05). Students prefer to walk in shorter distances during exam periods. Based on Games-Howell tests for the exam period, there was no significant difference for the travel distance between the choice of transport modes.

Table 7. Games-Howell Results

Transport mode	Distance to campus	N	X	F
Walking	Between 3-5 km	16	3.44	.447
	More than 16 km	3	4.00	

Transport mode	I (Distance to campus)	J (Distance to campus)	Mean Difference (I-J)
Walking	Between 3-5 km	More than 16 km	-.437*

*Mean difference is significant at the 0.05 level

5. Discussion

Chillón, Molina-García, Castillo, and Queralt (2016) confirms that university students living closer to university are more likely to active commute and the threshold distances that students walk and cycle to university are determined as 2.6 km and 5.1km, respectively. In this study, the travel distance to campus was only significant for walking. It was concluded that students walk only if they live close (3-5 km) to the campus.

The travel behavior of university students in different countries. The results of this study confirm that students are not keen on cycling in the campus. Although there is a bicycle lane in the campus, students find the lanes to narrow for cycling. Considering the weather conditions and air temperature in Eskisehir, walking and cycling were not the preferred transport modes. On the other hand, Nahal and Mitra (2018) indicate that women and transit pass holders are less likely, while students rather than staff are more likely to cycle during winter when travelling to the Ryerson University in Toronto, Canada. Nordfjærna, Egseta, and Mehdizadeh (2019) focuses on 41 university students in Norway and evaluate the transportation in two campuses. Results show that use of public transportation and private vehicle is more common in one of the campuses where, bicycle and walking on the other campus during winter.

The questions (Q.7, Q.10) were included to the questionnaire includes for the time intervals that students need to travel on-campus during the course and exam periods. Majority of the students stated that they never traveled on-campus during the time periods 19:00-20:00 and 20:00-21:00. In the following studies, this question may be revised as to define major time periods (i.e., Morning 8:00-11:00, Noon 11:01-13:00, Afternoon 13:01-17:00, Evening 17:01-21:00). By this means, the choice of on-campus travel mode can be assessed based on the time periods.

The question (Q.13) was included to the questionnaire to get the opinion on shared vehicles. Among the students, 32% stated that they have never heard about shared vehicles and 30% stated that they have used shared vehicles for distances shorter than 5 km. The students are asked to evaluate the shared vehicle apps are in the questionnaire (Q.14). In line with the previous question, students stated that they have no idea (35%) and find the app as useful (33%).

6. Conclusions

University campuses can be built in areas relatively far from residential centers, based on land costs, governmental supports, etc. This study aims to identify the preferred transport modes (i.e., walking, bicycle, motorcycle, e-scooter, car, ring line) in the campus. However, further analysis is also made to assess the distance to the campus. A questionnaire is designed to gather the students' view. A group of engineering students are selected for the purpose of the study. The questionnaire also includes questions related with motor vehicle license ownership. The transport mode preferences are discussed based on course and exam periods. The choice of travel alternatives is related to several factors (i.e., cost, social distance, travel distance, emission values, etc.). Weather conditions and air temperature was identified as critical factors for the transport mode preference. Although, the ring line was the most preferred alternative among others especially during exam periods, students request lower costs for this alternative.

The cost and speed factors are related to almost every alternative during the course and exam periods. The social distance has become more important during and after pandemics. Therefore, the number of students for each minibus in the ring line and the transfer schedule should be considered in detail.

Cycling and walking may help individuals to keep fit and sustain their personal health. Therefore, new projects for the on-campus transportation must be put in action and supported by the decision makers of the university to ease use of bicycle by providing bike racks for secure parking, bicycle-sharing programs, or rental services. Being a low-cost solution, walking should be promoted by enabling pedestrian-friendly sidewalks, crosswalks, and well-maintained paths. The golf carts that are used in some universities for campus maintenance and security personnel can be considered as an alternative for on-campus transportation by the students.

In future studies, the study can be repeated with more participants as to get the perception of academics and other university personnel. The factors that affect the

choice of transport models can be assessed based on different faculty members. The emission values of the motor vehicles can be considered to take actions for achieving a carbon-free campus. Further analysis can be made for different hour period of the day. Also, safety issues can be discussed especially for bad weather and evening time.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Contribution of Researchers

Furkan KELEŞ and Hasan ÖZGÜL: Conceptualization, Data gathering, Statistical analysis, Writing original draft.

Berna HAKTANIRLAR ULUTAŞ: Conceptualization, Methodology, Validation, Supervision, Writing, Reviewing, and Editing.

Conflict of Interest

No conflict of interest was declared by the authors.

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APPENDIX: SURVEY QUESTIONS

Please select the appropriate option for the following questions.

1.Gender
o F o M

2.Age range
o 17-19 o 20-22 o 23-25 o 26 and above

3. Motor vehicle license: Check the appropriate option(s)
o I don't have a driver's license
o A1 o A2 o A o B

4. Rate the distance of the accommodation to the campus, the time you attended face-to-face classes.
o Less than 3 km
o Between 3-5 km
o Between 6-10 km
o Between 11-15 km
o More than 16 km

5. Score the frequency of use of shared e-scooters for **off-campus** transportation.

Scooter Brand	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
X					
Y					
Z					
Other					

6. Score the frequency of use of shared e-scooters for on-campus transportation.

Scooter Brand	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
X					
Y					
Z					
Other					

7. Score the time intervals you need on-campus transportation most **during the course period**.

Time intervals	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
7:00-8:00					
8:00-9:00					
9:00-10:00					
10:00-11:00					
11:00-12:00					
12:00-13:00					
13:00-14:00					
14:00-15:00					
15:00-16:00					
16:00-17:00					
17:00-18:00					
18:00-19:00					
19:00-20:00					
20:00-21:00					

8. Score the frequency of your transportation on campus **during the course period.**

Mode of Transportation	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
Walking					
Bicycle					
Bicycle (s)					
E-Scooter					
E-Scooter (s)					
Motorbike					
Motorbike (s)					
Car					
Car (s)					
Ring Line					

9. Score the factors that affect your choice of transportation on campus **during the course period.**

Mode of transportation	Not important at all 1	Not important 2	Neutral 3	Important 4	Very important 5
Easy access					
Speed					
Cost					
Social Distancing					
Travel Distance					
Air Temperature					
Weather Conditions					
Emission Values					

10. Score the time intervals you need **on-campus** transportation **during the exam period.**

Time intervals	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
7:00-8:00					
8:00-9:00					
9:00-10:00					
10:00-11:00					
11:00-12:00					
12:00-13:00					
13:00-14:00					
14:00-15:00					
15:00-16:00					
16:00-17:00					
17:00-18:00					
18:00-19:00					
19:00-20:00					
20:00-21:00					

11. Score the frequency of your transportation on campus **during the exam period.**

Mode of Transportation	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
Walking					
Bicycle					
Bicycle (s)					
E-Scooter					
E-Scooter (s)					
Motorbike					
Motorbike (s)					
Car					
Car (s)					
Ring Line					

12. Score the factors that affect your choice of transportation on campus **during the exam period**.

Mode of transportation	Not important at all 1	Not important 2	Neutral 3	Important 4	Very important 5
Easy access					
Speed					
Cost					
Social Distancing					
Travel Distance					
Air Temperature					
Weather Conditions					
Emission Values					

13. Your opinion on shared vehicles.
- o I've never heard of it before.
- o I used it for short distance (less than 5 km) transportation purposes.
- o I used it for long distance (more than 5 km) transportation purposes.
- o I used it for short distance (less than 5 km) to try it out (for entertainment purposes).
- o I used it over a long distance (more than 5 km) to try it out (for entertainment purposes).

14. Evaluate the use of applications for shared vehicles.
- o I've never used it before. I have no idea.
- o I think the app is not useful at all.
- o Neutral. Some of the menus are handy.
- o I think the app is useful.
- o I think the app is very useful.

15. Which ways do you prefer/would you prefer during the use of shared vehicles in ESOGU Meselik Campus?

Road type	Never 1	Rarely 2	Sometimes 3	Often 4	Always 5
Motor vehicle road in the campus					
Bicycle path					
Sidewalk					

16. Evaluate the motor vehicle road within ESOGU Meselik Campus.
- o I never have problems.
- o I have problems occasionally (roads are too narrow).
- o I have problems occasionally (the roads are too crowded).
- o I have problems from time to time (the ground is bad, there is ice-snow on winter days, it is covered with leaves in autumn, etc.).
- o I have problems all the time.

17. Evaluate the bicycle paths within ESOGU Meselik Campus.
- o I never have problems.
- o I have problems occasionally (roads are too narrow).
- o I have problems occasionally (the roads are too crowded).
- o I have problems from time to time (the ground is bad, there is ice-snow on winter days, it is covered with leaves in autumn, etc.).
- o I have problems all the time.

18. Evaluate the sidewalks within ESOGU Meselik Campus.
- o I never have problems.
- o I have problems occasionally (roads are too narrow).
- o I have problems occasionally (the roads are too crowded).
- o I have problems from time to time (the ground is bad, there is ice-snow on winter days, it is covered with leaves in autumn, etc.).
- o I have problems all the time.

19. Would you like to take part in the development of a new project alternative for on-campus transportation?
- o I don't think there is a need for a new transportation alternative.
- o I can decide based on how much time the project will require.
- o I would like to contribute to the vehicle design phase.
- o I would like to contribute to the planning phase of the roads and/or route.
- o I would like to contribute to the next stage after the project is commissioned (problems encountered in the operation phase, etc.).

20. Other topics you would like to add related to the topic:
……..