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Introduction to Data Science
Midterm Project Report

The Effect of Residential Distance on Class Attendance Regularity Among University Students

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1. Abstract

Students in universities living in large cities are usually faced with challenging commute environments that may affect their effectiveness in education. For example, in a large city like Istanbul, commute time, traffic congestion, and the congestion of transport means may be a common occurrence. Although some studies have previously examined the link between commute environments and education effectiveness, studies targeting university students in large cities had not been previously undertaken.

This proposal aims to investigate the relationship between the average travel time of university students to their institution of study and their level of performance in academics, and the mediating process of the average sleep time and stress of the said students. A Quantitative Study shall be implemented in the process of data collection among students of a university through a structured online survey. Average travel time shall be measured by the average travel time one way to school, and performance in academics measured by the GPA level of the respondents.

There will also be descriptive statistics analysis, correlation analysis, in addition to carrying out mediation tests using regression analysis. The result of this study will help enhance, or add to, what is currently in the literature related to urban higher education, as well as student welfare issues related to commuting students.

2. Introduction

University students in large cities have to face many problems in commuting from home to campus and vice versa. In Istanbul, daily travels are influenced by heavy traffic, crowded public transportation, long distances, and unexpected delays. These challenges can pose serious problems for students, not only in the time they invest in academic work but also in their physical and mental preparation for learning. Since commuting is becoming the routine and unavoidable part of students' daily life, there is a growing need to learn about its possible influence on academics.

Regular class attendance and participation by students are considered vital to college success. Previous literature has identified that attendance is strongly associated with enhanced performance, enriched understanding of concepts, and increasing participation in academic life. However, class-attendance behaviors do not occur in a vacuum but are instead influenced by various environmental, social, and personal factors. Of these, transportation is a critical factor, which is often not so easily modified or controlled by most students. The length of travel time can limit the availability of time that students have to study, their energy levels, and their motivation to attend classes.

A growing body of international studies indicates that long commutes can have negative learning outcomes for students. Based on studies in Brazil, China, India, Pakistan, and other places, long travel to school may lead to reduced sleep time, enhanced levels of stress, and reduced academic performance. Even though these facts are meaningful, much of the existing literature focuses on students at K-12 or non-metropolitan areas. Few of the existing studies investigate the association between travel time and academic performance for university students in Turkey. The unique transportation challenges faced in cities like Istanbul predicate a further need to interrogate the issue of how commuting affects higher education students. This research tries to establish whether daily commuting time significantly impacts the academic performance of university students.

3. Literature Review

International research, in general, is highlighting the impact of commuting conditions on students' academic behaviors, their mental health, and performance. It seems that one problem, which is longer commutes, not only emerges from the time lost but is, in fact, structurally, disadvantageous in various studies on commuting. Burzacchi et al. (2024) by analyzing GPS-tracked mobility data of university students in Italy, conducted a significant study of commuting in higher education. They found that there was a significant relationship between longer times of commuting and low GPA condition, thus, the authors B. et al. said that the effect of commuting cancels the effect of the students' demographic and socioeconomic factors. That is why they think that commuting can be considered a logistical problem and a source of low energy, which is the reason for the lack of concentration and study time. In short, their research is describing a very basic model of how traveling daily burdens academic outcomes.

Some other researches have been looking at the matter of indirect links between the time spent on the road and the performance. To start with, Guan et al. carried out a research on a large group of rural students from China, and figured out that long and tiresome journeys were associated with sporadic sleep and tiredness, and this was claimed to be the main reason behind the low academic achievement. Their mediation analysis shows that sleep reduction is the main way in which longer commute times relate to difficulties in academic functioning. This consideration is particularly relevant to the present work, in which we also hypothesize that sleep duration can be a mediator for students living in different areas of the city at the university level.

Researchers have also documented the mental health impacts of commuting. Most of the research emphasize that lengthy commutes can cause stress that is one of the major consequences. Kaushik and Singh (2023) SSRN research, involving undergraduate engineering students, were able to demonstrate that longer commutes led to higher perceived stress that, in turn, resulted in compromised focus. In the same manner, the research published in the International Journal of Educational Studies (2025) among nursing students indicated that issues while commuting, like crowded transport and unexpected delays, lead to more stress and less readiness for academic work among students. The discoveries imply that stress may intervene between the relationship of performance and the burden of commuting. Besides stress and lack of sleep, commuting has also been linked to a decrease in the students' free time, that is, time not spent on duties. PLOS ONE in 2024 came with a study which made it clear that

4.Research Questions and Hypotheses

4.1 Research Questions

RQ1: Does daily commute time significantly affect academic performance among university students?

RQ2: Does daily commute time influence sleep duration and perceived stress, which may function as mediating factors in academic performance?

4.2 Hypotheses

$H1_0$ (Null Hypothesis): Daily commute time has no significant effect on academic performance among university students.

$H1_1$ (Alternative Hypothesis): Daily commute time negatively affects academic performance among university students.

$H2_0$ (Null Hypothesis): Daily commute time does not influence sleep duration or perceived stress, and these factors do not mediate the relationship between commute time and academic performance.

$H2_1$ (Alternative Hypothesis): Daily commute time influences sleep duration and perceived stress, and these factors mediate the relationship between commute time and academic performance.

5. Conceptual Framework

This framework of the research provides evidence that daily commute time serves as the most powerful predictor of students' academic performance. Moreover, it creates some premises to assume that prolongation of commuting time can negatively affect academic results not only directly but also by harming mediators of this relationship. Two such psychological and behavioral mediators that intervene between the commute time and academic performance link are sleep duration and perceived stress.

We chose sleep duration as a mediator because previous studies have documented that lengthy commutes affect students' sleep; specifically, their cognition, concentration, and memory are worse. We include perceived stress as another mediator because transportation problems, waiting times, and physical tiredness during travel increase the levels of stress among students, with negative consequences on their engagement with schoolwork.

This framework considers commute time as a structural barrier emanating from urban living conditions. In contrast, sleep duration and stress represent individual reactions that can either weaken or strengthen the impact on performance. The study is set up to test not only the direct effect of commute time on academic performance but also the indirect routes whereby commuting affects performance through psychological and behavioral factors.

The conceptual model with these mediators outlines that the relationship between daily commuting demands and students' well-being and academic behavior is complex. There is a theoretical justification for sleep and stress to be considered major mediating variables that link the impact of commuting to the academic success of university students.

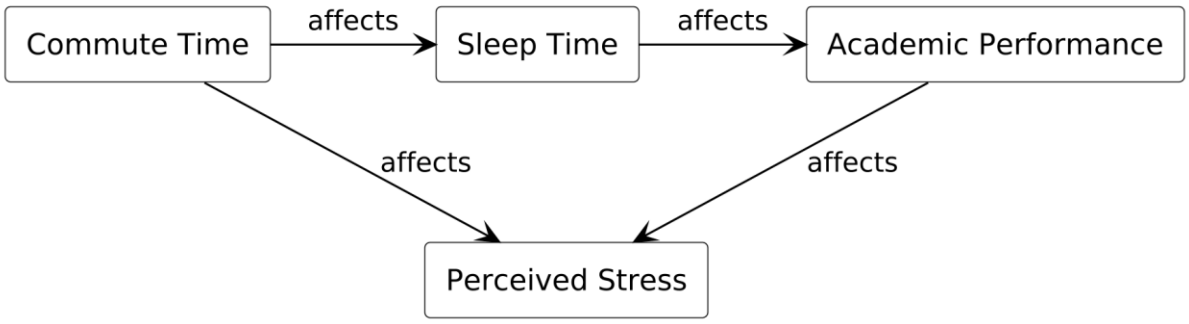

Figure 1. Conceptual model of the study.

6. Methodology

6.1 Research Design

This study employs a quantitative, cross-sectional research design to examine the relationship between daily commute time and academic performance among university students. The design is appropriate because the study aims to identify statistical associations between variables at a single point in time rather than track changes longitudinally. A survey-based methodology is utilized to gather self-reported data on commute duration, sleep patterns, perceived stress, and academic performance. This approach is widely used in commuter-related research and allows for efficient data collection from a large sample of students in a metropolitan context.

6.2 Population and Sample

The target population consists of undergraduate students enrolled in a metropolitan university in Türkiye. Given the transportation structure of Istanbul and similar large cities, students in this population experience diverse commuting patterns, making them suitable for the purpose of the study. A convenience sampling method will be used due to accessibility constraints and because it is commonly adopted in higher education research involving self-administered surveys. The anticipated sample size ranges from 150 to 200 participants, which is sufficient

for regression-based statistical analyses and aligns with the assumptions of the Central Limit Theorem.

6.3 Measures and Variables

Table 1. Description of the variables, measurement methods, and scale types used in the study.

Variable Type	**Variable**	**Measurement Method**	**Scale Type**	**Description**
Independent Variable	Commute Time	One-way commute duration (minutes)	Ratio	Average daily travel time from home to campus.
Dependent Variable	Academic Performance	Self-reported GPA (0–4 scale) or score	Ratio	Indicator of students' academic achievement.
Mediator	Sleep Duration	Average weekday sleep hours	Ratio	Assesses whether reduced sleep mediates the commute–performance link.
Mediator	Perceived Stress	Likert-type stress scale (5 items)	Ordinal	Measures perceived stress caused by commuting factors.

Control Variables	Age, Gender, Class Standing, Employment Status	Self-reported demographic categories	Nominal / Ordinal	Controls for alternative explanations affecting performance.

6.3.1 Independent Variable

Commute Time (minutes):

Measured as the average one-way duration of daily travel from home to campus. Participants will report this as a numerical value.

6.3.2 Dependent Variable

Academic Performance:

Operationalized through self-reported GPA or a standardized academic performance scale. Using a continuous measure ensures suitability for correlation and regression analyses.

6.3.4 Mediating Variables

1. Sleep Duration (hours): Measured as the average number of hours slept per night. This variable is included to test whether reduced sleep mediates the relationship between commute time and performance.

2. Perceived Stress: Assessed using a Likert-type scale adapted from widely used psychological stress inventories (e.g., PSS-based items). Higher scores reflect greater perceived stress.

6.3.5 Demographic Data

- Age
- Gender
- Class standing (freshman, sophomore, etc.)
- Employment status (part-time job)

These controls are included to rule out alternative explanations for differences in academic performance.

6.4 Data Collection Procedure

Data will be collected using an online questionnaire distributed through institutional communication channels, student mailing lists, and social media platforms. Participants will be informed of the purpose of the study, the voluntary nature of participation, and their right to withdraw at any time. No personal identifiers will be collected to ensure anonymity. The survey will be available for approximately one week, and responses will be exported to a statistical software environment for analysis.

6.5 Data Types

The dataset will include multiple measurement levels:

- Nominal: gender, employment status, class standing
- Ordinal: stress scale items, Likert-type responses
- Ratio: commute duration (minutes), sleep duration (hours), GPA
- Interval/Composite: multi-item stress score (if applicable)

These variable types inform the selection of statistical procedures and summary measures used in the analysis.

6.6 Planned Statistical Analyses

6.6.1 Descriptive Statistics

Before conducting inferential analyses, descriptive statistics will be computed for all variables:

- Measures of central tendency (mean, median, mode)
- Measures of dispersion (standard deviation, variance, range, interquartile range)
- Coefficient of variation
- Frequency distributions for categorical variables
- Graphical summaries (histograms for commute time and GPA, boxplots for sleep and stress)

6.6.2 Inferential Analyses

To test the research questions and hypotheses:

1. Pearson Correlation Analysis: To explore bivariate associations among commute time, sleep duration, stress, and academic performance.
2. Multiple Linear Regression: To determine whether commute time predicts academic performance after controlling for demographic variables.

3. Mediation Analysis: Regression-based mediation procedures (e.g., PROCESS Model 4 or equivalent) will be used to test whether sleep duration and perceived stress serve as mediators in the commute–performance relationship.

Assumptions of the analyses (normality, linearity, homoscedasticity) will be evaluated before conducting tests.

6.7 Ethical Considerations

Participation will be voluntary and anonymous. No personally identifiable information will be collected. Students will be informed about the purpose of the study, and consent will be assumed upon completing the survey. As the study involves minimal risk, additional ethical approval is not required for this midterm-stage proposal but may be sought during the final data collection phase.

7. Expected Outcomes

In line with the existing body of research, it is expected that a longer commute will be negatively correlated with academic performance. We expect that students who commute longer will suffer from less sleep and higher perceived stress. We anticipate that these two factors will serve as mediators for academic outcomes, meaning that the impact of commuting on academic performance may be through a combination of decreased sleep and higher stress. Therefore, we anticipate the following relationships to go in the expected direction:

Longer commute → lower academic performance

Longer commute → lower sleep & higher perceived stress

Sleep loss and stress may mediate the relation between commuting and academic performance.

In conclusion, we anticipate that distance and travel time serve as cumulative barriers that result in reduced academic engagement.

8. Conclusion

This is a cross-sectional study that puts forward an integrated framework to explore the academic consequences of the daily commute time of university students living in big cities. As the report suggests, commuting is one of the structural problems that, in the student's academic life, may affect various paths, such as lack of sleep, increase of stress levels, and lowering of cognitive readiness for learning. As per the previous research on the matter, conducted in different countries, long commuting hours seriously harm the well-being and academic functioning of students; however, little has still been done to produce research on

this matter for higher education students in Turkey, and particularly, in the urban areas that are densely populated, such as Istanbul.

This study creates a conceptual model that includes both the direct and indirect influences of the commute on academic performance. In this connection, the research questions and hypotheses put forward here are intended to reflect the complexity of such a relationship, while the methodology explains the plan for the next stage of the project concerning data collection and analysis.

The results anticipated in this research could influence institutional decision-making processes and be the driving force behind the development of policies aimed at supporting students who commute to achieve academic success. At the final stage of this project, real-world data will be gathered, analyzed, and interpreted to determine if the proposed relationships are statistically supported. Consequently, this report of the activities carried out at the midterm point provides an initial framework for a more in-depth investigation of how urban living features, as well as individual-level psychological and behavioral mechanisms, interrelate to produce higher education outcomes.

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