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Determinants of College and Graduate Students' Commute Time to School, Is the Residential Dwelling Type Related to School Commute Time?: The Case of Seoul Metropolitan Area

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Abstract: Commuting is a vital travel channel for college students throughout their higher education career; nevertheless, excessive commute time negatively impacts students' school satisfaction, academic achievement, health, and quality of life. Meanwhile, few studies have explored students' commute time, covering a large population and scope. Therefore, this study analyzes the dwelling type that influences college and graduate students' school commute times in the Seoul Metropolitan Area, using data from the 2016 Household Travel Diary Survey. This study uses spatial data on housing development to classify five dwelling types (i.e., new town, housing site development, Seoul, Incheon, and Gyeonggi-do). A multiple linear regression model empirically analyses students' household and personal characteristics. The results reveal that dwelling type significantly affects students' commute time. Specifically, Students living in Seoul have a shorter commute to school than those living in new towns. Socioeconomic characteristics have less effect on college and graduate students' school commute time. This study discusses the problem of excessive commuting of college and graduate students in new towns.

Keywords: commute time to school; dwelling type; household travel diary survey; college and graduate students; multiple linear regression model

1. Introduction

The development of new towns is seen as a key strategy for spreading population pressure in urban centers and alleviating urban problems such as rising rental costs and traffic congestion [1,2]. Similarly, Korea has experienced a severe shortage of housing in urban areas because of increasing urbanization since the early 1980s. In December of the same year, with the revision of the Residential Land Development Promotion Act, a series of residential land development projects and new town development programs were announced to be opened to alleviate the shortage of residential housing in the metropolitan area and the overconcentration of the urban population in the short term [3]. However, the difficulty of obtaining enough land within Seoul for large-scale new town development, coupled with strict greenbelt regulation [4,5], forced the Korean government of the time to site new towns away from Seoul and outside the greenbelt, some 20-45 kilometers from Seoul's central business district. Such an approach, while contributing to the stabilization of rising housing prices, accelerated urban sprawl, and generated higher social costs [6]. In particular, the increased commuting distances have led to longer trips. Earlier studies have pointed out that long commuting times to work in new towns affect the personal time management and quality of life of the residents of the new towns [6,7], who must live with the inconvenience of a long commute. Even though new towns have become the dominant form of urban expansion and development in Asian cities [8], research on long-distance commuting in new towns has focused mainly on commuting to

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work, while research on school attendance in new towns has not been given much attention [6,7,9–11]. According to [12]compared to commuting to work, commuting to school has less impact on the current urgent problems of traffic congestion and environmental pollution, and thus commuting to school has been overshadowed by commuting to work in urban mobility research. However, the role of school commuting in urban travel cannot be ignored. In 2014, the Korea Statistics Agency Survey on Residents' Living Time found that compared with 1999, the commute to work for the employed population aged over 20 years in the Seoul Metropolitan Area increased by an average of 11 minutes between 1999 (1 hour and 25 minutes) and 2014 (1 hour and 36 minutes), in terms of the proportion of long commutes. The 2015 Korea General Population Housing Survey of the commuter population found that the rate of employees whose commute to work took more than 1 hour increased from 9.5% in 1995 to 18% in 2015 (an 89.47% increase), while the percentage of students who commuted to school for more than 1 hour increased from 8.3% to 17.1% (a 106.02% increase). For commuters, longer distances to work may be tolerated as a trade-off for other benefits [13], but this trade-off does not exist for the student population.

Like commuting to work, commuting to school is students' most essential and frequent travel behavior, and it is permanent, fixed, and limited by choice. These limitations affect students' attendance in class and at necessary campus activities and extend to where their commute departs from and by what means it is conducted. For example, compared with students who live alone, students who live with their families or partners are more likely to report that their commute time negatively affects their campus attendance, engagement, extracurricular experiences, course selection, and academic success [14,15]. Moreover, while adjustments to the parking fee system will affect university teaching and administrative staff's use of car commuting, college students will not be as affected because they often lack access to a personal vehicle due to financial constraints [16].

Thus, like workplace employees, college students often perform long-distance commutes; nevertheless, the factors constraining and influencing students' commuting behaviors differ. According to [17], long-distance travel to school can be viewed as a "tax" on a family's resources because they must make time or budget to accommodate the student's longer trip. This mandatory "tax" does not apply to all student families; after all, there are differences in housing, transportation affordability, and transportation resources among student families with different incomes.

The development of new towns should not only aim at a high degree of "self-containment" but also consider social equity among different groups. This study analyzes the factors affecting college students' commuting time and the degree of their influence through research and discovers the differences in the educational conditions of college students from the perspective of commuting, to have an empirical understanding of the commuting time of college students. This paper takes dwelling type as an entry point to analyze how the type of development of residential location affects the commuting time of college students. Through literature and data analysis, the factors affecting college students' commuting time are summarized, and based on the empirical results, some suggestions, and recommendations to improve college students' commuting to school are proposed, considering the actual situation of college students' long commuting time in the Seoul metropolitan area.

The remainder of the paper is organized as follows: Section 2 provides a comprehensive overview of the effects of urban development characteristics on commuting, research on the factors that contribute to employee commute times to and from work, and previous literature on college students' commute times to and from school. Section 3 explains the analytical approach and data construction process of this study. In addition, Section 4 tests the research questions through empirical analysis. Section 5 discusses the results of the analysis. Finally, Section 6 summarizes the paper and provides relevant insights and recommendations.

2. Literature Review

2.1. Determinants of Students' Commute Time to School

The Seoul metropolitan area is the economic, technological, and cultural center of South Korea, and has the densest distribution of higher education resources and the largest higher education

population in the country. As of 2020, the tertiary education completion rate of young people aged 25-34 in South Korea is 69.8%, ranking first among OECD member countries [18]. Currently, there are 115 universities in the Seoul metropolitan area, including national, public, and private universities, and approximately 1.09 million undergraduate and graduate students commute to and from school using the urban transportation system.

The extant studies on college students' commute time to school have predominantly focused on transportation choice and access satisfaction. First, numerous factors influence college students' choice of transportation means, and empirical analysis has been conducted regarding the physical environment, socioeconomic, access, and psychological characteristics. Regarding physical environment characteristics, essential factors include walking distance, time, and infrastructure supply density. Specifically, students living on or around campus are more likely to walk and cycle than to drive alone [19]. Moreover, road density (or road rate) and the planned density of urban pedestrian paths also impact students' choice of transportation means. Road density or road rate positively affects the efficiency of cars and buses; however, these means of transport are negatively affected by an increase in the density of pedestrian paths [20]. Socioeconomic characteristics, such as sex, educational level, age, income, and residential status (living alone or with parents), also impact students' choice of transportation means [21–23]. Generally, girls are significantly less likely to walk than to cycle than boys but are more likely to walk than to use a car [24,25]. Students who do not live with their families prefer walking to school over cycling [20,22]. Additionally, discounted transit or increased parking fees can reduce driving and encourage students to use mass transit modes actively [25,26].

Interestingly, a study on students at a Canadian university found that factors such as safety consciousness and environmental awareness influenced college students' choice of transportation means [27]. Students who valued safety and the environment chose non-motorized means, such as walking and cycling. Simultaneously, the probability of walking to school decreases with travel time, while the probability of taking the subway increases slightly. The probability of traveling by bus and by car is comparable if the distance to the school campus is short, but the probability of commuting by car increases when the travel time exceeds 10 minutes. Further, the condition of the available transportation in the surrounding area impacts students' choice of transportation means [20]. Nash and Mitra [28] found that students' preferred mode of transportation differed depending on the student's sex, grade level, family members, and whether they were full-time or not. Other studies on driving active travel among college students [20,22,28] have indicated that reducing barriers to public transportation use, mainly through bus or bicycle use compensation, could allow students' transportation access patterns to be converted to sustainable transportation access. These studies have significantly contributed to understanding the characteristics of college students' commuting behavior to school. Through extensive empirical analysis, they have illustrated that college students' choice of transportation patterns plays a pivotal role in environmental protection and sustainable resource use.

These studies have identified a strong relationship between students' commute time and participation in school activities, academic achievement, satisfaction, and well-being. Longer commute time significantly decreases student school satisfaction [27]. Research from India suggests that excessive commuting time has a negative impact on academic performance, with more than half of students believing that excessive commuting time affects their personal attendance status [29]. The same study on commuting students in the UK elaborated that because of commuting, students must choose between the cost of commuting and the value of academic engagement [30]. The longer the commute time for off-campus students, the lower their GPA will be compared to students who live on or around campus [31]. Moreover, the longer the commute time to school, the greater the likelihood of interruptions to students' schooling [14,32,33]. Finally, students who have longer commute times significantly to school generally have extremely low GPAs and high dropout rates [32,36].

2.2. Suburban New Towns and Commuting Patterns

Cases exploring empirical analyses of commuter travel behaviors of suburban residents in new towns have mostly been studied in cities in Europe and North America [2,37–42]. Relatively few studies have been conducted on cities in Asian countries with high population concentrations. Ref. [6]'s study measured the commuting costs of siting new towns in the Seoul metropolitan area outside the urban green belt. The results of the study showed that leapfrog development generated commuting costs of $250 million per year while leading to a serious occupational/residential imbalance, particularly in terms of increased commuting distances to the central city and increased commuting dependence of new town residents. [43] analyzed the impact of different scenarios with and without new towns using a counterfactual scenario approach. The results of the analysis show that while on the positive side, the development of new towns has eased traffic congestion in central cities and consequently saved nearly $600 million per year in transportation costs, the positive impacts have been offset by the negative impacts of longer commuting and shopping times and increased automobile emissions associated with the suburbanization of new towns. Therefore, the location of new town development is important for urban form and transportation patterns.

Ref. [10] research on Chinese cities has explored the role of income and new town type on commuting. It found that higher-income commuters tended to have longer commuting distances and times and were more likely to drive to their workplaces. People living in residential new towns tended to have longer commuting distances and times. At the same time, there are different characteristics of different types of new towns in terms of transportation resources, with residents of residential new towns being more likely to use public transportation for their daily commute, and high-income residents of new towns commuting longer distances than residents of other areas based on income type. However, these distances are still shorter than those of low-income residents of the new town. Like most cities in the world where new towns are developed, Hong Kong's new towns were originally developed to relieve overcrowding in existing urban areas. The study on the commuting of Hong Kong's new town residents yielded nearly similar results to the Seoul New Town Study [44], The analysis shows that while new town development has been effective in dispersing the population from urban centers, the poor supply of employment opportunities and schooling facilities in the new towns has led to extensive and significant cross-border commuting between the new towns and the older urban areas.

Thus, while new towns have been effective in relieving population pressure on urban centers, their success in achieving the goal of self-sufficiency is rather limited, as commuting between new towns and built-up urban areas remains important. Most employment opportunities are concentrated in built-up urban areas, and does the cost and time of commuting to urban areas become a burden for disadvantaged groups in new towns? Existing studies have not explored this point comprehensively enough.

2.3. Determinants of Employees' Commute Time to Work

The main factors influencing travel patterns are land use and socioeconomic factors—also referred to as "soft" factors [45]. Hanson [46] argues that sociodemographic factors may be more critical than land-use factors for most travel patterns. In addition, there may be a strong link between commuting patterns and urban form, but the causal mechanisms are difficult to explain. While commuters and college students do not differ significantly in terms of commuting accessibility, they may differ significantly in terms of commuting patterns, speeds, and distances due to trade-off effects. For example, given the same urban form and commuting distance, commuters can adjust their commuting time by choosing a faster or slower commuting mode. For college students, this commuting tradeoff depends more on their family's economic income level. Theoretically, in contrast, socioeconomic factors seem to be more critical to the study of college students' commute times.

In the existing research on socioeconomic factors of employee commuting time, Sex is an important factor influencing commuting behavior. Numerous studies have shown that women have

shorter commuting distances and times than men [47–54] due to family responsibilities and shorter work returns; thus, they choose to work closer to home [52,53]. Naturally, when women's work hours are equal to men's, the women's work commutes will be the same or even longer.

Páez and Farber [55] found a non-linear relationship between an individual's age and their commute time, with middle-aged individuals commuting for longer than younger and older individuals. Further, the distance that individuals commute increases with age and peaks between the ages of 40 and 44 [56]. Conversely, [52] shows a weak relationship between age and travel distance.

Household income may influence individual commute time through trade-off effects [47,48,51,53,57,58]. Some studies have shown a positive relationship between income and commute time [47,48,53,57]. However, more recent evidence, noted by Zhao and Lü [54], is consistent with other studies [51,58] that have shown that higher household income is associated with lower commute time, seemingly due to the greater ability of higher-income households to choose housing locations with shorter commute times.

Students who live in multi- and single-family housing, residential-commercial complexes (e.g., officetels in Korean law), and other types of dwellings, have shorter commute times than those who live in apartments [47,48]. Meanwhile, residential-commercial complexes have better proximity to public transportation [59]. Moreover, the commute time to work is shorter for regular workers and salespeople compared to temporary workers and those in other occupations [50]. Finally, those who live in dual-income households and own the residence they live in spend less time commuting to work [47,48,50,60].

Research on employee commute time to work has been more extensive. However, research on exactly what factors influence students' commute time is less comprehensive. There is about our study aims to provide a more comprehensive empirical analysis case based on existing research using extensive data surveys to explore the factors that constrain and determine the commute time of undergraduate and graduate students.

3. Model and Survey

3.1. Hypothesis and Analysis Model

This study's spatial scope uses the Seoul Metropolitan Area as it comprises more than half of the country's population and has heavy urban traffic. This study considers university and graduate students in higher education as the study target.

Accordingly, this study's research hypotheses are as follows: (1) Do students living in new towns have a longer commute to school than those living in Seoul? (2) Are there differences in school commute time among college students with different family income types? (3) Do residential development type characteristics strongly influence college students' school commute time when controlling for socio-demographic and economic characteristics?

This study applied multiple linear regression analysis models to analyze the personal, family, development, choice of transportation means, and mass transit proximity conditions' characteristics that affected the college and graduate students' commute time to school. The model is as follows:

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 \tag{1}$$

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 \tag{2}$$

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 \tag{3}$$

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} \tag{4}$$

where Y represents the dependent variable, which is the commute time to school; I represents the ith data (or the ith student); β represents the coefficient of each explanatory variable; X is the independent variable; x1, x2, x3, x4, x5, x6, and x7 are the individual and household characteristics;

x8 represents the development characteristics; x9 represents the transportation means characteristics; and x10 and x11 are the public transportation use proximity characteristic variables.

3.2. Data and Variables

This study used the 2016 Household Travel Diary Survey to analyze the factors influencing the university and graduate students' commute time. This survey is administered every five years based on individual and household statistics. Survey data include the number of household members, type of residence, income level, household vehicle ownership, individual household member profiles, and transportation trip data. Given that the population of the current study was college and graduate students, data from the 2016 Household Travel Diary Survey were selected alongside data on college and graduate students' enrollment in formal educational institutions, provided that the purpose of commuting to school was determined. In addition, anomalies in the data that were far from most sample points and did not fit the actual situation were removed from this study. Therefore, outliers with commuting times exceeding 240 minutes (N=21) were omitted from the analysis to ensure that the data were realistic. Finally, 7474 survey data were available for analysis.

Further, to determine the students' dwelling type, this study used the spatial data of residential developments. It used ArcGIS 10.1 to classify the data into five dwelling types: new towns, housing site development, Seoul, Incheon, and Gyeonggi-do. new towns are large-scale housing sites (more than 3300000 m²) that include transportation modes, green spaces, and amenities. The government comprehensively plans to solve the problem of difficult housing in the Seoul Metropolitan Area and disperse the population within 20–40 km of Seoul. The construction of new towns in Korea began in the late 1960s with the initial aim of solving the problem of having cities or big cities located in industrial complexes. In the 1980s, Mokdong and Idong in Seoul developed into housing-oriented urban new towns, while the first batch of five new towns, including Bongdang and Ilsan, was built to address the shortage of housing land in central Seoul. The second batch of new towns was planned and announced in 2003 to curb soaring real estate prices in Seoul and expand the housing supply in the Seoul Metropolitan Area. Dwelling types are distinct from new towns because they are generally led by local self-governing bodies or private construction companies to rapidly increase planned residential supply in the downtown areas of existing cities. The development areas generally range from 100000 m2 to 3300000 m2 and are much smaller than the new towns in their development cycle.

This study's dependent variable is the students' commute time to school. School commute time is defined as the time taken from the place of residence to the destination. The entire school commute process does not include cases in which other purposeful activities are conducted in the middle of the commute. The calculation of time use includes the time spent moving to a transportation mode, time spent using transportation, and time spent waiting for transportation.

The independent variables include personal, family, development, transportation mode, and distance traveled characteristics. Personal characteristics include sex, age, and possession of a driver's license. Household characteristics include the number of household members, number of valuable vehicles owned by the household, housing type, and average monthly household income. The housing types are classified as apartments, multi-family, single-family, and residential/commercial complexes. Condominiums are distinguished from other housing types by their physical nature and appearance, as they generally require five or more stories by law. Multi-family, single-family, and detached houses, which are low-rise buildings (i.e., five stories or less), differ slightly from a legal aspect but have similar physical characteristics. Thus, they are grouped for this study. Residential-commercial complexes are generally close to subway station areas; hence, occupants have an advantage in terms of their proximity to public transportation. Development characteristics mainly describe the five dwelling types (i.e., new towns, housing site development, Seoul, Incheon, and Gyeonggi-do). The physical characteristics and availability of transportation facilities vary by the development type. Transportation characteristics describe the main transportation options for students' commute to school, including non-motorized travel (i.e., walking, cycling), private vehicle, public transportation, and other modes. Focus on commuting to

school. This study designates the mode of transportation that takes the longest throughout the entire commute as the primary mode of transportation. For example, in the case of a student who starts from their residence, walks to the subway station, takes the subway, goes to the subway station near their destination, and then continues to walk to their destination, this study designates the mass transit mode as the primary mode of transportation. As transferring between the subway and bus for free in a short time is possible, the subway and bus are classified as mass transit trips when used together in the same period. Finally, the proximity characteristics include two variables: time spent walking to the nearest subway station and the nearest bus stop (Table 1).

Table 1. Definition of Variables.

Variable	Description	Data Source
Dependent variable	Commute time to school	Household Travel Diary Survey (2016)
Personal Characteristics		
Sex	Male (ref.), female	Household Travel Diary Survey (2016)
Age	Year	
Driver's license	Yes (ref.), no	
Household characteristics		
No. of family members	Person	Household Travel Diary Survey (2016)
Car ownership	Yes (ref.), no	
Housing type	Apartment (ref.), multifamily housing, single-family housing, residential commercial complex (e.g., officetel), other	Household Travel Diary Survey (2016)
Monthly household income	Less than KRW 3 million (ref.), between KRW 3–5 million, more than KRW 5 million	
Development characteristics		
dwelling type	New towns (ref.), Seoul, Housing land development, Gyeonggi-do, Incheon	Housing Site Information System (2016)
Choice of transportation means characteristics		
Main transportation means	Public transportation (ref.), non-motorized travel, private vehicle, and other	Household Travel Diary Survey (2016)
Public transportation proximity characteristics		
Time spent walking to the nearest bus stop	Minutes	Household Travel Diary Survey (2016)
Time spent walking to the nearest subway station	Minutes	

Note: KRW 1022 ≈ USD 1 as of December 2016.

4. Results

4.1. Descriptive Analysis

Table 2 shows that, on average, college students spend 69.76 minutes commuting to school. College students are generally a low-income group and do not have a strong need for a driver's license, but the results show that 42.90% of college students have already obtained a driver's license. This is because the job market in Korea has become more competitive in recent years, and the acquisition of practical skills, such as a driver's license, has become a consensus among many university students.

Table 2. Descriptive analysis.

Variable	Mean/n	SD/Ratio	Min.	Max.
Commute time to school	69.76	36.06	2.00	240.00
Personal characteristics				

Sex	Male	3808	50.95		
	Female	3666	49.05		
Age		22.05	2.97	15.00	84.00
Driver's license	Yes	3206	42.90		
	No	4268	57.10		
Household characteristics					
No. of family members		3.51	0.98	1.00	5.00
Car ownership	Yes	6020	80.55		
	No	1454	19.45		
Housing type	Apartment	4626	61.87		
	Multifamily housing	1538	20.58		
	Single-family housing	1142	15.28		
	Residential-commercial complex (e.g., officetel) and other	170	2.27		
Monthly household income	Less than KRW 3 million	1833	24.53		
	Between KRW 3–5 million	2906	38.88		
	More than KRW 5 million	2735	36.59		
Development characteristics					
dwelling type	New towns	470	6.29		
	Seoul	2887	38.63		
	Housing land development	1177	15.75		
	Gyeonggi-do	2317	31.00		
	Incheon	623	8.34		
Choice of transportation means characteristics					
Main transportation means	Non-motorized travel	638	8.54		
	Private vehicle	317	4.24		
	Public transportation	6495	86.90		
	other	24	0.32		
Public transportation proximity characteristics					
Time spent walking to the nearest bus stop		5.18	2.65	1.00	30.00
Time spent walking to the nearest subway station		11.09	8.88	1.00	132.00

Regarding household characteristics, 80.55% of households own a vehicle. Moreover, 61.87% have an apartment, 20.58% have a multi-family house, and 15.28% have a single-family house. More than 75.67% of the total sample have an average monthly income of more than KRW 3 million (the average monthly income of Korean households in 2016 was about KRW 3.71 million). The highest number of students (38.63%) live in Seoul, while less than 6.29% of students commute from the new towns and dwelling types. Public transportation (86.90%) is students' most popular mode of access, while 7.83%. According to the two indicators of mass transit proximity, on average, it takes 5.18 minutes to walk to the nearest bus stop and 11.09 minutes to walk to the nearest subway station, with standard deviations of 2.65 and 8.88 observed for these two variables, respectively, which are less than the means. This indicates that overall, public transit proximity is reasonable.

Based on the proposed hypothesis, this study conducted a multivariate analysis of variance (MANOVA) test to determine whether there were significant differences in the different groups of students commute time to school in terms of housing type and monthly household income.

MANOVA refers to a complex form of ANOVA used to compare multiple indicators among multiple groups to study the effect of control variables on multiple dependent variables.

This study uses the ggbetweenstats • ggstatsplot package in R-studio to create violin plots, by which we can obtain more visual information from the analysis results. It is intuitive to check the visual distribution of differences in a continuous variable across multiple groups/conditions for comparison and to check for outliers. Doing so can reveal issues challenging to observe from numerical data alone. As can be seen from the visual graphs (Figures 1–3), most evidently reveal that most of the four independent variables show a relatively concentrated sample distribution and a minimal distribution of outliers that do not significantly impact the actual situation reflected by the overall sample. The results of the variance test indicate a statistically significant difference between the groups of the four independent variables.
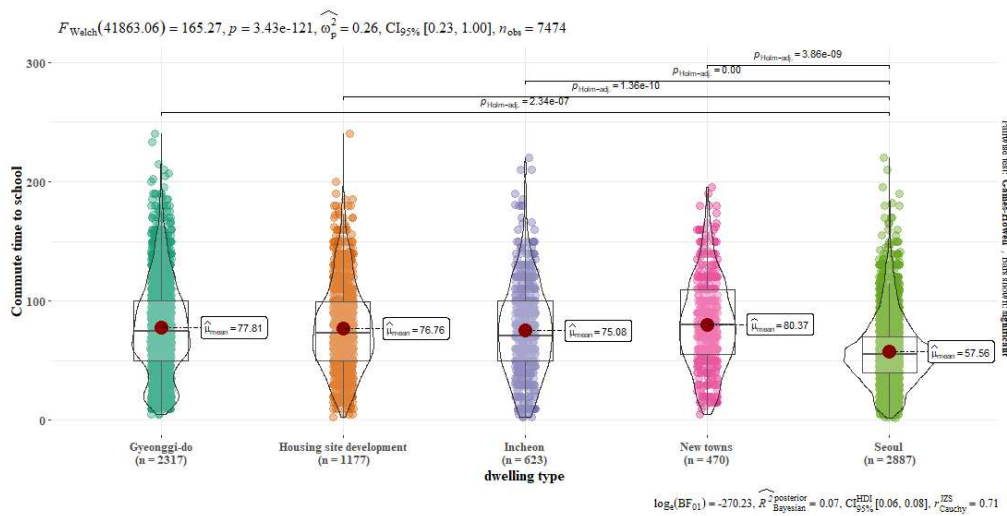

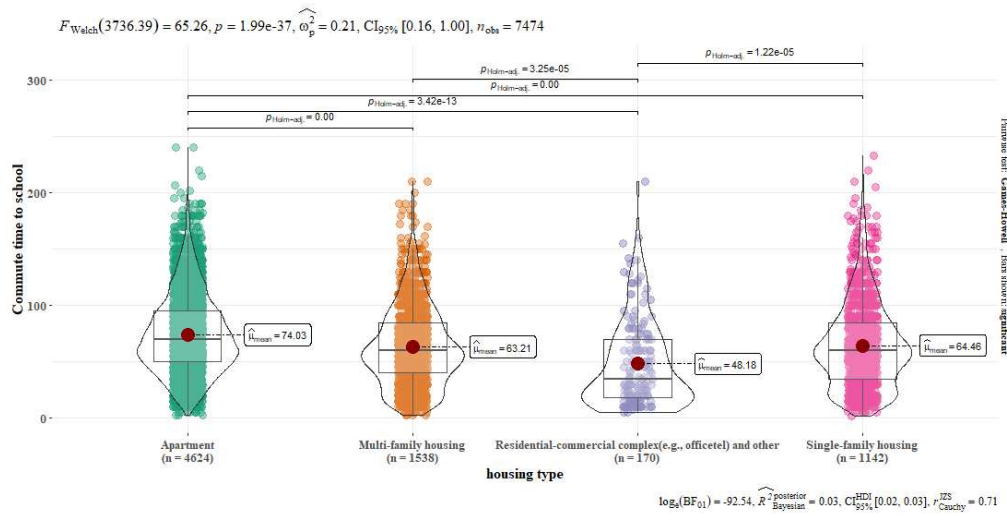**Figure 1.** Data differences in commute time to school between dwelling types.

Figure 2. Data differences in commute time to school between housing types

$F_{\text{Welch}}(2{,}4387.96) = 41.34,\ p = 1.64\text{e-}18,\ \widehat{\omega}_p^2 = 0.02,\ \text{CI}_{95\%}\ [0.01,\ 1.00],\ n_{\text{obs}} = 7474$

$p_{\text{Holm-adj.}} = 7.14\text{e-}09$

$p_{\text{Holm-adj.}} = 7.14\text{e-}09$

$\widehat{\mu}_{\text{mean}} = 72.58$

$\widehat{\mu}_{\text{mean}} = 62.67$

$\widehat{\mu}_{\text{mean}} = 71.50$

Between KRW 3-5 million
(n = 2906)

Less than KRW 3 million
(n = 1833)
monthly household income

More than KRW 5 million
(n = 2735)

$\log_e(\text{BF}_{01}) = -40.56,\ \widehat{R^2}^{\text{posterior}}_{\text{Bayesian}} = 0.01,\ \text{CI}^{\text{HDI}}_{95\%}\ [8.05\text{e-}03,\ 0.02],\ r^{\text{JZS}}_{\text{Cauchy}} = 0.71$
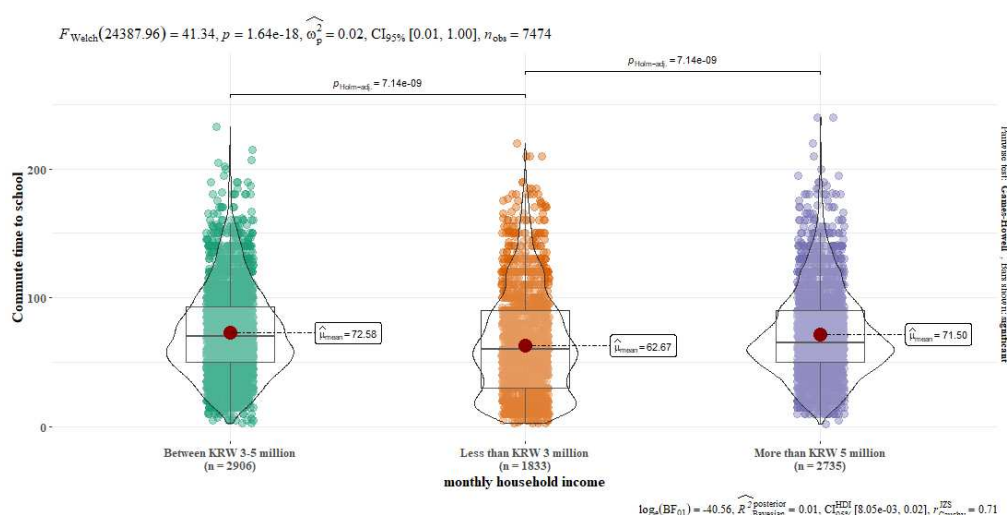
Figure 3. Differences in commute time to school between monthly household income types

Dwelling type analysis of variance showed that students living in Seoul (57.56 minutes) had significantly shorter commute times than those in new towns (80.37 minutes). Regarding average monthly household income, the commute time to school for low-income households (i.e., monthly income less than KRW 3 million) is 62.78 minutes. Conversely, the average commute time to school is longer for middle-income (72.58 minutes) and high-income (71.57 minutes) households.

4.2. Multiple Linear Regression Analysis

Table 3 shows that all individual characteristics in Models are not significant. Regarding household characteristics, the number of household members (+), household vehicle ownership (-), multi-family (-), single-family (-), officetels and other housing types (-), and average monthly household income of more than KRW 5 million significantly affect students' commute time. The higher the number of household members, the lower the number of households without vehicles. The higher the number of multi-family, single-family houses, and other housing types with an average monthly income of more than KRW 5 million, the shorter the commute time.

The spatial data of housing development estimates suggest that large-scale apartments are being continuously built on the city's outskirts, resulting in longer commuting hours for students who live in apartments. Among the housing types, students living in other housing types (e.g., officetels) spend 14 minutes less commuting than students living in apartments. This is because most officetels are located around the station areas; thus, the accessibility to public transportation is satisfactory. Students from high-income households (those with an average monthly income of 5 million won or more) spend more time commuting than those from low-income households. This is consistent with the analysis of commute time, which reveals that high-income households' students have relatively lower economic constraints than low-income households' students when determining their housing choice, resulting in more housing choices. Regarding the significant explanatory variables, walking has the highest standardization coefficient; thus, improving the choice of transportation means should be prioritized to shorten the students' commute time.

The commute time of students who live in Seoul is significantly shorter than those who live in the new towns. This is because Seoul has satisfactory higher education functions, contains most colleges and universities, and has satisfactory transportation conditions comprising a closer transportation network and various transportation modes compared to other regions. Moreover, the new towns are developed on a large scale due to the lack of housing supply in the city, and meeting the location conditions of university campuses for land planning, land price, and size is difficult. Therefore, there are few nearby university campuses in the new towns. Accordingly, the college students who live in the new towns have the longest commute time to school, and the higher the number of household members, the longer the commute time. A previous study on commuting

traffic found that complex factors (e.g., household income and workplace location) also increased as the number of household members increased.

Students who live in apartments have longer commutes than those who live in single-family apartments. Compared with other housing types, single-family homes have certain limitations in the location of apartments, which is the reference variable. Apartments are more closely related to urban diffusion among housing types than single houses. It can be said that in the process of urban expansion, to alleviate urban density, the supply scale of apartments will spread to the city's periphery. At the same time, single-family houses will not develop to the periphery with the spread of the city. Therefore, people living in large apartment complexes generally need more commute time.

The previous studies' analysis of the determinants of commute time shows that high-income households have a shorter commute time than low-income households [51–54]. This study reveals that income affects commute time because high-income households are relatively less restricted than low-income households due to their reduced travel time. Specifically, students from high-income households live near schools or use fast transportation modes, such as cars, which results in shorter commutes.

Regarding transportation characteristics, the primary means of transportation are derived in the order of the time required to commute non-motorized travel (walking and cycling), other modes, by car, and public transportation. This is because students generally only walk and cycle for short distances; thus, they require less time to commute when compared to using public transportation, while students more often use passenger cars rather than public transportation for long-distance commutes. Meanwhile, walking to the nearest subway station is directly proportional to the commute time.

			MODEL 1			MODEL 2			MODEL 3			MODEL 4		
			B	β	VIF	B	β	VIF	B	β	VIF	B	β	VIF
		Constant	57.937***			63.988***			80.008***			78.523***		
Personal characteristics		Sex (male=0, female=1)	-0.475	-0.007	1.078	-0.655	-0.009	1.078	-1.107*	-0.015	1.080	-1.045	-0.014	1.080
		Age	-0.067	-0.006	1.094	-0.041	-0.003	1.094	0.125	0.010	1.104	0.136	0.011	1.107
		Driver's license (yes=0, no=1)	0.474	0.007	1.147	0.786	0.011	1.148	-0.959	-0.013	1.159	-0.885	-0.012	1.161
Household characteristics		No. of family members	5.706***	0.154	1.505	5.138***	0.139	1.512	1.582***	0.043	1.568	1.559***	0.042	1.569
	Car ownership	(yes=0, no=1)	-8.544***	-0.094	1.518	-6.471***	-0.071	1.530	-2.393**	-0.030	1.560	-2.595**	-0.028	1.563
	Housing type (ref.=apartment)	Multifamily housing	-7.455***	-0.084	1.140	-3.129***	-0.035	1.225	-1.219	-0.014	1.229	-0.986	-0.011	1.237
		Single-family housing	-7.058***	-0.070	1.098	-5.622***	-0.056	1.157	-2.139**	-0.021	1.164	-1.879*	-0.019	1.175
		Officetels and others	-14.248***	-0.059	1.089	-12.220***	-0.051	1.096	-2.785	-0.012	1.106	-2.327	-0.010	1.107
	Monthly household income (ref.=under KRW 3 million)	Between KRW 3–5 million	-1.169	-0.016	2.101	1.840	0.025	2.141	-0.954	-0.013	2.149	-1.064	-0.014	2.150
		More than KRW 5 million	-4.622***	-0.062	2.283	-0.599	-0.008	2.357	-1.770	-0.024	2.359	-1.732	-0.023	2.359
Development characteristics	dwelling type (ref.=new towns)	Seoul				-20.012***	-0.270	4.570	-21.464***	-0.290	4.582	-21.789***	-0.294	4.592
		Housing land development				-3.899**	-0.039	2.976	-4.378**	-0.044	2.977	-4.613***	-0.047	2.980
		Gyeonggi-do				-0.594	-0.008	4.233	1.256	0.016	4.238	1.589	0.306	4.252
		Incheon				-4.786**	-0.037	2.165	-5.578***	-0.044	2.166	-7.636***	-0.059	2.236
Choice of transportation means characteristics	Main transportation means (ref.=public transportation)	Non-motorized							-55.047***	-0.427	1.184	-55.070***	-0.427	1.185
		Private vehicle							-33.783***	-0.189	1.047	-33.506***	-0.187	1.048
		Other							-43.406***	-0.068	1.005	-43.322***	-0.068	1.005
Public		Time spent walking to the nearest										-0.195	-0.014	1.037

transportation proximity characteristics	bus stop							
	Time spent walking to the nearest subway station					0.221***	0.054	1.083
	N	7474	7474	7474	7474			
	R2	0.063	0.121	0.303	0.306			
	Adjusted R2	0.062	0.119	0.301	0.304			
	F	50.577***	73.312***	190.326***	172.592***			

Note: * $p<0.10$, ** $p<0.05$, *** $p<0.0$.

5. Discussion and Conclusion

This study analyzes the determinants of commuting time for college and graduate students in the Seoul metropolitan area. The study used multiple regression analysis to derive a statistically significant model with commuting time and time spent using transportation as dependent variables. Through Model 4, we also found that No. of family members (-), Car ownership (-), Single-family housing (-), Seoul (-), Housing site development (-), Incheon (-), non-motorized travel (-), Private vehicle (-), Time spent walking to the nearest subway station (+) variables were statistically significant. Specifically, students living in the nearest subway station had a longer commute time (21.88 minutes) compared to students living in Seoul, general residential areas, and Incheon. Even when the time spent walking to transportation is excluded from Model 2, students living in new towns have longer commute times (17.69 minutes) than students living in Seoul and residential developments. This is because students living in new towns are spatially distant from the city center, despite the continuous buffering of construction and infrastructure in new towns. In terms of transportation characteristics, non-motorized travel commuting presupposes a short commuting distance, but non-motorized travel to and from school takes nearly an hour less than taking public transportation. However, for the same motorized commute, it takes half an hour less by car than by public transport. In terms of distance from public transportation, proximity to subway stations reduces commuting time, which is also reflected in the shorter commuting time of students in officialetels and other housing types in Korea that are located mainly around subway stations.

Model 1 focuses on analyzing the effects of socioeconomic variables on students' total commuting time, and it was found that the type of residence, number of family members, vehicle ownership, housing type, average monthly household income, choice of transportation, and walking time to the nearest subway station affect the total commuting time. Among the average monthly household income variables, students from higher-income households had shorter commute times to school compared to college students from lower-income households. By distinguishing between individual and family characteristics, the individual characteristics variable is not significant for college students' commuting time to school, while in contrast, family characteristics are more determinative of commuting time to school for college students.

Model 2 examines the effect of development characteristics on commuting time to school after controlling for socioeconomic characteristics. The results show that college students living in Seoul (-), Housing site development (-), and Incheon (-) have shorter commute times to school than those living in new towns. Moreover, among the control variables, the Monthly household income variable is insignificant. In this regard, the results of [61] showed that the higher the level of education, the smaller the effect of demographic factors on school travel time, while at the same time, the variables related to urban form showed a greater effect. The results of this study reconfirm the findings of [61].

This study found that development characteristics have a significant impact on the commuting time of college students. At the same time, the influences that determine commuting to school are completely different compared to the determinants of travel time to work and work.

As the main body of higher education and advocates of future social development, university students have stronger rational understanding and judgment and can respond to and more actively practice reasonable policies and regulations that are conducive to improving the environment [26]. Therefore, analyzing the commuting behavior of university students can help to achieve the goals of the Seoul 2030 Transportation Vision, which is to increase the proportion of green transportation (e.g., walking, biking, and use of public transportation modes) from the current 70% to 80% by 2030, and to reduce per capita greenhouse gas emissions from the current 1.2 tons/year to 0.8 tons/year.

Therefore, policymakers, transportation planners, and urban planners need to understand how commuting to school differs from commuting to work. Improving the quality of college students' commute to school should focus more on their household characteristics to achieve more effective outcomes. To close the gap in college student commute times, policymakers, urban planners, and transportation planners should develop and implement programs that address these factors, such as

road construction, public transportation, or policy housing construction. Of course, improving the efficiency of public transportation is crucial, but it often takes a lot of time and money to achieve. Therefore, it may be faster and more efficient to provide housing for the university student population near campuses or in places with good access to public transportation to shorten commuting distances.

Finally, a surprising finding of our analysis is that household characteristics significantly influence college students' commute time more than personal characteristics. Their household characteristics often determine college students' commute time.

Three aspects of this study are likely to be improved by future research. First, there is a large sample of survey data on actual household access conditions but insufficient survey content on student access characteristics. Future research should examine influences not considered in this study, such as access costs, environmental conditions, Etc. Second, this study analyzed data from the 2016 Seoul Metropolitan Area Household Travel Survey. Compared with the 2021 Seoul Metropolitan Area Household Travel Survey data, it is possible to compare the impact of changes in support policies for youth, such as youth housing and happy housing, on commute time. Third, due to data limitations, the analysis was assigned to 2016, while the second construction phase of the new town has not yet been completed, and commute time may be extended due to the lack of basic transportation facilities. Investigating this issue is a task for the future.

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References

1. Alexander, A. Planning a New Towns. *Britain's New Towns: Garden Cities to Sustainable Communities*. 1st ed, Routledge: Britain, 2009.
2. Hall, P. Cities of Tomorrow: An Intellectual History of Urban Planning and Design since 1880. 4th ed, Basil Blackwell: Oxford, UK, 2014.
3. DooHwan, G.; ChangGyu, C. Commuting Distance and Mode Choice of Residents in the New Developments and the Existing Urban Areas in Gyeonggi-Do - Comparing the First-Stage New Towns, the Ordinary Housing Land Developments(OHLD). *Journal of Korea Planning Association* **2013**, *48*, 83–106.
4. Choi, C.G.; Lee, S.; Kim, H.; Seong, E.Y. Critical Junctures and Path Dependence in Urban Planning and Housing Policy: A Review of Greenbelts and New Towns in Korea's Seoul Metropolitan Area. *Land Use Policy* **2019**, *80*, 195–204, doi:https://doi.org/10.1016/j.landusepol.2018.09.027.
5. Vongpraseuth, T.; Seong, E.Y.; Shin, S.; Kim, S.H.; Choi, C.G. Hope and Reality of New Towns under Greenbelt Regulation: The Case of Self-Containment or Transit-Oriented Metropolises of the First-Generation New Towns in the Seoul Metropolitan Area, South Korea. *Cities* **2020**, *102*, 102699, doi:https://doi.org/10.1016/j.cities.2020.102699.
6. Jun, M.-J.; Hur, J.-W. Commuting Costs of "Leap-Frog" Newtown Development in Seoul. *Cities* **2001**, *18*, 151–158, doi:https://doi.org/10.1016/S0264-2751(01)00007-5.
7. Jun, M.-J. Commuting Patterns of New Town Residents in the Seoul Metropolitan Area. *Journal of Korean Regional Development Association.* **2000**, *12*, 157–170.
8. Peiser, R. *New Towns for the Twenty-First Century: A Guide to Planned Communities Worldwide.* University of Pennsylvania Press. **2021**, https://doi.org/10.2307/j.ctv16qjxm2.
9. He, S.Y.; Chen, X.; Tao, S. Long Commutes, Work-Life Balance, and Well-Being: A Mixed-Methods Study of Hong Kong's New-Town Residents. *Journal of Planning Education and Research 0(0)*, **2023**, doi:10.1177/0739456X231188301.

10. Li, S. (Alex); Zhao, P. Examining Commuting Disparities across Different Types of New Towns and Different Income Groups: Evidence from Beijing, China. *Habitat International* **2022**, *124*, 102558, doi:10.1016/j.habitatint.2022.102558.

11. He, S.; Tao, S.; Ng, M.; Tieben, H. Evaluating Hong Kong's Spatial Planning in New Towns From the Perspectives of Job Accessibility, Travel Mobility, and Work–Life Balance. *Journal of the American Planning Association* **2020**, *86*, 1–15, doi:10.1080/01944363.2020.1725602.

12. Goeverden, C.D. van; Boer, E. de School Travel Behaviour in the Netherlands and Flanders. *Transport Policy* **2013**, *26*, 73–84, doi:https://doi.org/10.1016/j.tranpol.2013.01.004.

13. Lyons, G.; Chatterjee, K. A Human Perspective on the Daily Commute: Costs, Benefits and Trade-offs. *Transport Reviews* **2008**, *28*, 181–198, doi:10.1080/01441640701559484.

14. Leveson, L.; McNeil, N.; Joiner, T. Persist or Withdraw: The Importance of External Factors in Students' Departure Intentions. *Higher Education Research and Development* **2013**, *32*, 932–945, doi:10.1080/07294360.2013.806442.

15. Rotaris, L.; Danielis, R. The Impact of Transportation Demand Management Policies on Commuting to College Facilities: A Case Study at the University of Trieste, Italy. *Transportation Research Part A: Policy and Practice* **2014**, *67*, 127–140, doi:10.1016/j.tra.2014.06.011.

16. Henning, E.; Ferreira Schubert, T.; Ceccatto Maciel, A. Modelling of University Student Transport Mode Choice in Joinville: A Binary Logistic Model for Active Modes. *Journal of Sustainable Development of Energy, Water and Environment Systems* **2020**, *8*, 678–691, doi:10.13044/j.sdewes.d7.0303.

17. Rich, P.M.; Jennings, J.L. Choice, Information, and Constrained Options: School Transfers in a Stratified Educational System. *American Sociological Review* **2015**, *80*, 1069–1098, doi:10.1177/0003122415598764.

18. OECD (2020), *Education at a Glance 2020: OECD Indicators*, OECD Publishing, Paris, https://doi.org/10.1787/69096873-en.

19. Wang, X.; Khattak, A.J.; Son, S. What Can Be Learned from Analyzing University Student Travel Demand? *Transportation Research Record* **2012**, *2322*, 129–137, doi:10.3141/2322-14.

20. Whalen, K.E.; Páez, A.; Carrasco, J.A. Mode Choice of University Students Commuting to Schooland the Role of Active Travel. *Journal of Transport Geography* **2013**, *31*, 132–142, doi:10.1016/j.jtrangeo.2013.06.008.

21. Zhou, J. Sustainable Commute in a Car-Dominant City: Factors Affecting Alternative Mode Choices among University Students. *Transportation Research Part A: Policy and Practice* **2012**, *46*, 1013–1029, doi:https://doi.org/10.1016/j.tra.2012.04.001.

22. Zhou, J. From Better Understandings to Proactive Actions: Housing Location and Commuting Mode Choices among University Students. *Transport Policy* **2014**, *33*, 166–175, doi:10.1016/j.tranpol.2014.03.004.

23. Yang, Ji-Hyun; Joh, C.-H. An Analysis of University Students' Trip Destination Choice Behavior Focusing on the Influential Factors. *Journal of the Economic Geographical Society of Korea* **2016**, *19*, 68–82, doi:10.23841/egsk.2016.19.1.68.

24. Akar, G.; Fischer, N.; Namgung, M. Bicycling Choice and Gender Case Study: The Ohio State University. *International Journal of Sustainable Transportation* **2013**, *7*, 347–365, doi:10.1080/15568318.2012.673694.

25. Nguyen-Phuoc, D.Q.; Amoh-Gyimah, R.; Tran, A.T.P.; Phan, C.T. Mode Choice among University Students to School in Danang, Vietnam. *Travel Behaviour and Society* **2018**, *13*, 1–10, doi:10.1016/j.tbs.2018.05.003.

26. Zhou, J.; Wang, Y.; Wu, J. Mode Choice of Commuter Students in a College Town: An Exploratory Study from the United States. *Sustainability* **2018**, *10*, doi:10.3390/su10093316.

27. Taylor, R.; Mitra, R. Commute Satisfaction and Its Relationship to Post-Secondary Students' Campus Participation and Success. *Transportation Research Part D: Transport and Environment* **2021**, *96*, 102890, doi:10.1016/j.trd.2021.102890.

28. Nash, S.; Mitra, R. University Students' Transportation Patterns, and the Role of Neighbourhood Types and Attitudes. *Journal of Transport Geography* **2019**, *76*, 200–211, doi:10.1016/j.jtrangeo.2019.03.013.

29. Asha Kaushik, G.T., Sunil Rai; Kumar, P. Effect of Commuting on the Academic Performance of Students in Higher Technical Education and Their Physical and Emotional State. *Innovations in Education and Teaching International* **2023**, *0*, 1–12, doi:10.1080/14703297.2023.2216677.

30. Thomas, L. 'I Use My Time More Wisely…' The Implications for Learning and Teaching in Higher Education of More 'Commuter Students.'; June 2018.

31. Nelson, D.; Misra, K.; Sype, G.E.; Mackie, W. An Analysis of the Relationship between Distance from Campus and GPA of Commuter Students. *Journal of International Education Research* **2016**, *12*, 37–46.

32. Shin, Hye Sook; Kim, M.-H. The Effects of Commuting Time on the Intention to Drop-out Focusing on the Mediation Effect of Commitment to College. *Korean Education Inquiry* **2018**, *36*, 25–44.

33. Turley, R.N.L.; Wodtke, G. College Residence and Academic Performance: Who Benefits from Living on Campus? *Urban Education* **2010**, *45*, 506–532, doi:10.1177/0042085910372351.

34. Khalil, L.J.; Khair, M.G. Social Network Analysis: Friendship Inferred by Chosen Courses, Commuting Time and Student Performance at University. In Proceedings of the International Journal of Reasoning-based Intelligent Systems; 2018; Vol. 10, pp. 59–67.

35. Shannon, T.; Giles-Corti, B.; Pikora, T.; Bulsara, M.; Shilton, T.; Bull, F. Active Commuting in a University Setting: Assessing Commuting Habits and Potential for Modal Change. *Transport Policy* **2006**, *13*, 240–253, doi:10.1016/j.tranpol.2005.11.002.

36. Tigre, R.; Sampaio, B.; Menezes, T. The Impact of Commuting Time on Youth's School Performance. *Journal of Regional Science* **2017**, *57*, 28–47.

37. Smith, W.S. Mass Transport for High-Rise High-Density Living. *Journal of Transportation Engineering* **1984**, *110*, 521–535.

38. Cervero, R. Jobs-Housing Balancing and Regional Mobility. *Journal of the American Planning Association* **1989**, *55*, 136–150, doi:10.1080/01944368908976014.

39. Nowlan, D.M.; Stewart, G. Downtown Population Growth and Commuting Trips: Recent Experience in Toronto. *Journal of the american planning association* **1991**, *57*, 165–182.

40. McNally, M.G.; Kulkarni, A. Assessment of Influence of Land Use–Transportation System on Travel Behavior. *Transportation Research Record* **1997**, *1607*, 105–115.

41. Cervero, R. Sustainable New Towns: Stockholm's Rail-Served Satellites. *Cities* **1995**, *12*, 41–51, doi:https://doi.org/10.1016/0264-2751(95)91864-C.

42. Giuliano, G.; Small, K.A. Is the Journey to Work Explained by Urban Structure? *Urban studies* **1993**, *30*, 1485–1500.

43. Jun, M.-J. The Effects of Seoul's New-Town Development on Suburbanization and Mobility: A Counterfactual Approach. *Environment and Planning A* **2012**, *44*, 2171–2190.

44. Hui, E.C.M.; Lam, M.C.M. A Study of Commuting Patterns of New Town Residents in Hong Kong. *Habitat International* **2005**, *29*, 421–437, doi:https://doi.org/10.1016/j.habitatint.2004.01.001.

45. Dong Lin, A.A.; Cui, J. The Impacts of Urban Spatial Structure and Socio-Economic Factors on Patterns of Commuting: A Review. *International Journal of Urban Sciences* **2015**, *19*, 238–255, doi:10.1080/12265934.2015.1016092.

46. Hanson, S. The Determinants of Daily Travel-Activity Patterns: Relative Location and Sociodemographic Factors. *Urban Geography* **1982**, *3*, 179–202, doi:10.2747/0272-3638.3.3.179.

47. LeeMinju; Kwon, P. A Study on the Spatial Mismatch by Income and Regional Characteristics. *Journal of the Korean Regional Science Association* **2016**, *32*, 67–82.

48. Yoon, InHa; Kim, H.-Y. A Study on Commuting Patterns in Seoul Metropolitan Area, 1990-1996. *Journal of Korea Planning Association* **2003**, *38*, 87–97.

49. Joo, J.H.; Yeon, J.Y.; Jang, D.I. Analysis on Passenger Car Travel Characteristics by Household Type. *Journal of Korean Society of Transportation* **2014**, *32*, 347–356, doi:10.7470/jkst.2014.32.4.347.

50. Lee, B.S.; McDonald, J.F. Determinants of Commuting Time and Distance for Seoul Residents: The Impact of Family Status on the Commuting of Women. *Urban Studies* **2003**, *40*, 1283–1302.

51. Gordon, P.; Kumar, A.; Richardson, H.W. Gender Differences in Metropolitan Travel Behaviour. *Regional Studies* **1989**, *23*, 499–510, doi:10.1080/00343408912331345672.

52. Schwanen, T.; Dieleman, F.M.; Dijst, M. Travel Behaviour in Dutch Monocentric and Policentric Urban Systems. *Journal of Transport Geography* **2001**, *9*, 173–186, doi:10.1016/S0966-6923(01)00009-6.

53. Turner, T.; Niemeier, D. Travel to Work and Household Responsibility: New Evidence. *Transportation* **1997**, *24*, 397–419, doi:10.1023/A:1004945903696.

54. Zhao, P.; Lü, B. Transportation Implications of Metropolitan Spatial Planning in Mega-City Beijing. *International Development Planning Review* **2009**, *31*, 235–261, doi:10.3828/idpr.31.3.2.

55. Páez, A.; Farber, S. Participation and Desire: Leisure Activities among Canadian Adults with Disabilities. *Transportation* **2012**, *39*, 1055–1078, doi:10.1007/s11116-012-9385-x.

56. Newbold, K.B. Age and Domestic Migration Effects on Workers' Commuting Distance. *Transportation* **2022**, doi:10.1007/s11116-022-10341-5.

57. Song, Y.-S.; Nam, J.; Kim, D.- G Identifying the Factors Affecting Commuting Travel Time by Family Types in Seoul. *Journal of Korea Planning Association* **2008**, *43*, 7–20.

58. Hanson, S.; Johnston, I. Gender Differences in Work-Trip Length: Explanations and Implications. *Urban Geography* **1985**, *6*, 193–219, doi:10.2747/0272-3638.6.3.193.

59. Ha, J.; Lee, S. Analysis on the Determinant Factors of Commuting Time by Individuals' Life Cycle Stage - Based on the 2010 Household Travel Survey Data of the Seoul Metropolitan Area -. *Journal of Korea Planning Association* **2017**, *52*, 135–152, doi:10.17208/jkpa.2017.08.52.4.135.

60. Kim, H.W.; Kim, H. Emergence of New Towns and Changes in Commuting Patterns of Seoul Residents. **2011**, *14*, 437.

61. Bautista-Hernández, D.A. Determinants and Metropolitan Patterns of School Travel Time. Is Location Associated with Average Years of Schooling?: The Case of Mexico City. *Cities* **2023**, *139*, 104408, doi:https://doi.org/10.1016/j.cities.2023.104408.

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