Decoding Behavioural Norms in School Mobility: A Structural Equation Modelling Analysis

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Abstract: - Travel demand modelling for school travel, remains a subject of limited research. The exploitation of factors influencing parents in school mode choice and the understanding of the significance parents attribute to these factors is important, contributing to transport planning and leading to a strategic direction with an ultimate scope to improve the school transportation system and promote the use of alternative transport modes for upgrading the living environment and quality of life in general. The current paper examines the development of a Structural Equation Model (SEM) describing the interrelationships between the factors influencing parents in the decision-making process and the final mode choice. For that, a questionnaire survey is conducted for parents of children aged six to eighteen years old. The collected data are analysed through Exploratory and Confirmatory Factor Analysis. Following, an SEM is developed examining the proposed authors' conceptual model, basic hypotheses of school travel choice, and direct and indirect correlations of factors composing parental behaviour.

Key-Words: - Structural Equation Model, mode choice, school trip, school transportation system, alternative transportation

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1 Introduction

School mobility is an integral and important parameter of social activities as it ensures students' right to education, while at the same time contributing to knowledge acquisition, socialization, and adoption of mobility behavioural patterns, [1]. The design, organization, and general functioning of a school transportation system, is a research subject that gained ground within the last decades among the global scientific community. However, in Greece, the research on related issues is still in its early stages, [2].

The overall view of students' mobility patterns is a particular scientific subject addressing not only transport experts and transport planners but also public health scientists and policymakers. Nevertheless, school trip modelling remains a subject of limited research. Investigating the factors that influence parents in the school mode choice and understanding the importance they attribute to these factors, is particularly important for transport planning and for shaping the appropriate strategic directions towards an overall improvement of the school transportation system.

Based on the above, the current paper presents the development of a methodological framework that investigates and analyses in-depth, personal hidden characteristics influencing parents in the school mode choice process. The research examines aspects of human behaviour in terms of school trip completion and reveals the importance that parents attribute to specific factors which positively or negatively affect the selection of the transport mode students use for traveling from their residence to their school unit and vice versa.

According to the existing literature, a significant number of researchers have concluded the most basic factors that influence the school mode choice. Examples include: student's gender, [3], [4], [5], [6],

[7], student's age, [8], [9], [10], parents' attitude towards the use of alternative transport modes, [11], [12], [13], [14], [15], [16], distance, [17], [18], [19], [20], [21], built environment, [4], [20], [22], [23], [24], and road safety, [25], [26], [27].

Based on the above-defined factors, a questionnaire survey was designed by the authors and used as the main tool for primary research and data collection. The main stages of the research include i) a questionnaire survey conducted to students' parents; the survey was designed after having investigated the type of variables involved in the process of selecting a transport mode, ii) correlations' analysis through the application of Exploratory and Confirmatory Factor Analysis (EFA, CFA) and iii) Structural Equation Model (SEM) development, highlighting direct and indirect interrelations between the independent variables presenting positive or negative effect on school mode choice.

2 Methodology

2.1 Questionnaire Survey Conduction

For the primary research and data collection procedure, a questionnaire was designed based on an in-depth literature review analysis conducted to identify the factors affecting parents in the school mode choice process. The research questionnaire has a structured character of a clear and predefined sequence of consecutive questions. It consists of three sections collecting i) data on various socio-economic characteristics of participants, ii) information regarding the factors that seem to motivate parents in the school trip mode choice process, iii) information regarding parents' mobility patterns and perceptions regarding the use of specific transport modes.

The sections of the questionnaire are as follows. The first one includes questions regarding the socio-economic characteristics of the respondents. The second part includes questions regarding school trips completion, while the third part consists of three subsections: in the first one, eighteen crucial factors that motivate parents in the mode choice decision process are given for the level of significance to be defined. For that purpose, a typical 5-level Likert scale is used (1 corresponds to very significant, and 5 corresponds to not significant at all). Following, in the second sub-section, the role of the structured environment in which students travel is examined. Parents are asked to declare their level of agreement or disagreement in 13 statements describing the environment that includes the route students follow from their residence to the school unit and vice versa. Once again, a 5-level Likert scale is used for that purpose (1 corresponds to strongly agree, 5 corresponds to strongly disagree). The questionnaire is completed in the third sub-section where fifteen statements related to parents' travel habits are examined to identify the impact of their perception on the selection of different school transport modes.

The survey took place in Thessaloniki city, the second largest city in Greece, numbering approximately one million residents and 100,000 students. In total, 512 parents of Primary and High Public-School students of the Thessaloniki Metropolitan area participated in the questionnaire survey that took place from May to June and from September to November 2019. The minimum sample size was defined based on the following method, [28]:

$$n \geq N \cdot \left(1 + \frac{N-1}{p \cdot (1-p)} \cdot \left(\frac{d}{z_{\alpha/2}} \right)^2 \right)^{-1} \quad (1)$$

where:

- N size of the population, e.g., the total number of students in the under-study area,
- n sample size, that is, the number of individuals required to respond to achieve the desired level of accuracy,
- p a probability parameter estimating the chance that the sample contains a specific characteristic. It is an estimation of the proportion of people (with a specific characteristic) falling into the group in which we are interested within the population. If no previous experience exists (as in the case of our survey), then a percentage p = 50% is considered the worst case, [28],
- d margin of error that we could accept or tolerate, such as say ±5%. The margin of error describes how close the answer of the sample is to the true value of the population. It is evident that the smaller the margin of error is, the closer the findings of the survey are to reality,
- $z_{\alpha/2}$ parameter related to the confidence level (c), which measures how certain we can be that the sample accurately reflects the population within its margin of error. For c = 90%, $z_{a/2}$ = 1.645, for c = 95%, $z_{a/2}$ = 1.960, and for c = 98%, $z_{a/2}$ = 2.326 (values of $z_{a/2}$ are derived from the two-tailed standard normal distribution, [28]).

Based on Eq. (1) and for N = 100,000 students, p = 50%, d = ±5%, and $z_{\alpha/2}$ = 1.96 (confidence level 95%), we calculated that at least 383 questionnaires were required to be completed. However, in total 512 were collected and used for the SEM development. The questionnaires' completion followed a two-fold process. In person, interviews were conducted while also parents were invited to complete the questionnaire online by using a google docs format file received in their e-mails.

2.2 Exploratory Factor Analysis Results

The Exploratory Factor Analysis (EFA) was initially adopted to investigate and identify the factors (latent variables) that the 49 observed variables (questionnaire items) may form. Initially, the variables were tested regarding their correlations (use of Pearson coefficient). The results showed that there is a large number of statistically significant correlations making it possible to group the observed variables into factors. Due to the high correlation between the two items representing the preferred mode of transport (residence to school and school to residence route), only one was used in the analysis. Regarding the EFA, the principal axis factoring method was deployed using the direct oblimin rotation technique, due to the fact that high correlations (>0.32) in more than 10% were found in the factor matrix when the varimax rotation technique was initially applied, [29].

Out of 49 observed variables, 6 were not included in the analysis as their weights were found to be less than 0.05. In more detail, the observed variables excluded are: student's gender, lack of appropriate infrastructure for cyclists, constant use of the private vehicle may form a student's dependency on this mode, private vehicle use contributes to traffic congestion, car ownership may be a symbol of prestige and the traffic congestion does not bother me. Additionally, travel cost and family income although presented with statistically acceptable weights were finally excluded from further analysis, as for a factor's creation more than two observed variables are required, [29], while also these two variables could be inserted separately into the final SEM as exogenous in order their influence to be examined. The rotation technique identified 9 factors with eigenvalues greater than 1, accounting for 61% of the total data variation. Based on the variable's conceptual framework, the factors' labelling followed (Table 1).

2.3 Confirmatory Factor Analysis Results

To investigate whether the observed variables' attribution to the factors is valid, a Confirmatory Factor Analysis (CFA) was applied, allowing the correlation between the latent variables and the errors of the observed variables under the use of modification indices. Several are the reasons for examining the correlation between latent variables and errors of observed variables, namely:

- Identification of model: correlations' estimation determines the error variance in the observed variables (not accounted for latent variables), leading to a distinction between the measurement error and the true constructs represented by the latent variables.
- Model fit assessment: the examination of correlations between latent variables and errors provides useful insights for the model's adequacy. If a lack of significant correlations is noticed, problems with measurement are possible to occur.
- measurement precision understanding; examining the correlations, it can be well assessed to what degree the observed variables capture the latent constructs. The higher correlations between latent variables and errors noticed the higher precision in measurement is assured, suggesting that the observed variables are reliable indicators of the constructs.

According to the CFA, all observed variables were found to be statistically significant (p-values<0.001), indicating and confirming their significant contribution to the creation of factors. Figure 1 illustrates the flowchart of interrelations between the variables.

Covariances between factors connected with two-way arrows in Figure 1, (e.g., MOTMODE and ATTCAR) are those found highly correlated when allowed to covariate. Similarly, covariances between errors connected with two-way arrows (e1–e7) reveal a high correlation between the observed variables (e.g., MOTsaf and MOTdist). Correlations between errors are only allowed for variables belonging to the same factor and not for different ones.

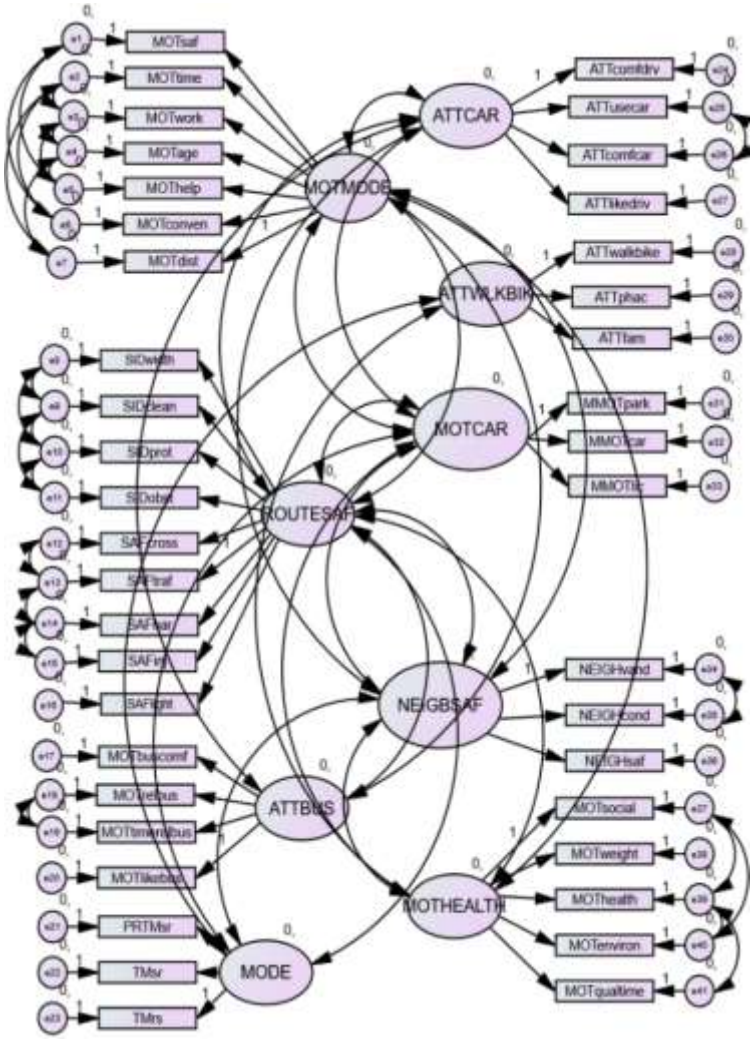

Fig. 1: Covariances' significance between the factors and the errors of the observed variables

Table 1. Exploratory Factor Analysis: Factors labelling and description

	Questionnaire items (observed variables)	Factor (latent variable) name/ Factor description
1	Student's safety (MOTsafe)	MOTMODE: Objective parameters of parental motivation to choose a transport mode
2	Travel time (MOTtime)	
3	Parents' working hours (MOTwork)	
4	There is someone to help (MOThelp)	
5	Student's age (MOTage)	
6	Student's convenience (MOTconven)	
7	Distance from residence to school unit (MOTdist)	
8	Student's socialization (MOTsocial)	MOTHEALTH: Parameters of parental motivation to choose a transport mode related to the physical and mental health of a student
9	Student's health (MOThealth)	
10	Luggage weight (MOTweight)	
11	Environmental sensitivities (MOTenviron)	
12	I have more quality time with my child during the school trip (MOTqualtime)	
13	Satisfied with the comfort of urban bus services (MOTbuscomf)	ATTBUS: Parents perception regarding the use of public bus
14	Urban bus is a reliable transport mode (MOTrelbus)	
15	Satisfied with time reliability with urban bus services (MOTtimerelbus)	
16	I like traveling by urban bus within the city (MOTlikebus)	
17	Current transport mode used, School-Residence (TMsr)	MODE: Parameters related to the current and the preferred mode of choice
18	Preferable transport mode, School-Residence (PRTMsr).	
19	Current transport mode used, Residence-School (TMrs)	
20	I like driving within the city (ATTlikedrive)	ATTCAR: Parents perception regarding the use of private vehicle
21	I use my car for all trips within the city (ATTusecar)	
22	Driving is more comfortable than walking/bicycling (ATTcomfcar)	
23	Owing a car makes my life comfortable (ATTcomfdrv)	
24	I would prefer my child walk or drive to school under different circumstances (ATTwalkbike)	ATTWALKBIK: Parents' perception regarding the use of non-motorized transport modes (walking-bicycle)
25	Walking/bicycling to school is a good way for my child to be familiar with the environment (ATTfam)	
26	Walking or cycling to school increases students' physical activity (ATTphac)	
27	Parent's car ownership (MMOTcar)	MOTCAR: Parameters related to the usability of private vehicle
28	Parent's driving license possession (MMOTlic)	
29	There are no parking limitations outside my residence or the school unit (MMOT park)	
30	There are no trails of vandalism in the neighborhood (NEIGHvand)	NEIGBSAF: Parameters related to the sense of security provided by the neighbourhood
31	Residences of the neighborhood are in good condition (NEIGHcond)	
32	The neighborhood the student travels to is safe (NEIGHsaf)	
33	Sidewalks have sufficient width (SIDwidth)	ROUTESAF: Parameters related to safety sense provided by the sidewalks and the whole path the student follows
34	Sidewalks are clean (SIDclean)	
35	Sidewalks are separated from traffic with trees (SIDprot)	
36	There are no obstacles on the sidewalks (SIDobst)	
37	Crossings are safe (SAFcross)	
38	Traffic conditions are not dangerous for students (SAFtraf)	
39	It's unlikely for my child to be harassed by others (SAFhar)	
40	It's unlikely for my child to be injured or abducted by a stranger (SAFinj)	
41	There is adequate lighting in the school trip route (SAFlight)	

Table 2 presents the results of all covariances included in the model (variables and errors). All covariances were found statistically significant ($p<0.05$, therefore the null hypothesis for non-significant covariances can be safely rejected).

Regarding the CFA's modification indices values, these were calculated within the permissible limits of international literature, indicating a good model's adaption. To further evaluate the model's adequacy, reliability analysis was performed through Cronbach's alpha. All values were above 0.70 and therefore none of them should be eliminated indicating the high homogeneity of the variables and their matching to the relative factor.

Table 2. Regression weights and statistical significance of observed variables and factors

			Estimate	Standard error	Critical ratio	Level of significance (p-values)
ROUTESAF	↔	NEIGBSAF	0.349	0.042	8.219	< 0.001
ROUTESAF	↔	MOTCAR	-0.231	0.043	-5.423	< 0.001
ROUTESAF	↔	ATTCAR	0.094	0.029	3.220	0.001
ROUTESAF	↔	MODE	-0.330	0.065	-5.086	< 0.001
MOTMODE	↔	NEIGBSAF	-0.087	0.023	-3.797	< 0.001
MOTMODE	↔	MOTCAR	0.354	0.046	7.756	< 0.001
MOTMODE	↔	ATTCAR	-0.072	0.022	-3.282	0.001
MOTMODE	↔	ATTBUS	-0.061	0.020	-3.144	0.002
ATTCAR	↔	NEIGBSAF	0.103	0.025	4.086	< 0.001
MOTCAR	↔	NEIGBSAF	-0.122	0.034	-3.576	< 0.001
MODE	↔	NEIGBSAF	-0.303	0.059	-5.160	< 0.001
MODE	↔	MOTCAR	0.349	0.076	4.590	< 0.001
MODE	↔	ATTWLKBIK	-0.124	0.049	-2.533	0.011
ATTCAR	↔	MOTCAR	0.126	0.035	3.612	< 0.001
ATTBUS	↔	ATTCAR	0.163	0.031	5.234	< 0.001
ROUTESAF	↔	ATTBUS	0.090	0.022	4.005	< 0.001
MOTMODE	↔	ROUTESAF	-0.215	0.032	-6.643	< 0.001
MOTHEALTH	↔	NEIGBSAF	-0.114	0.029	-3.915	< 0.001
MOTHEALTH	↔	MOTCAR	0.525	0.057	9.229	< 0.001
MOTHEALTH	↔	ATTWLKBIK	0.060	0.020	2.915	0.004
MOTHEALTH	↔	ROUTESAF	-0.215	0.037	-5.764	< 0.001
MOTHEALTH	↔	MOTMODE	0.461	0.050	9.147	< 0.001
e14	↔	e15	0.519	0.042	12.354	< 0.001
e9	↔	e8	0.307	0.035	8.746	< 0.001
e5	↔	e3	0.377	0.054	7.002	< 0.001
e7	↔	e2	0.298	0.039	7.618	< 0.001
e13	↔	e12	0.148	0.033	4.518	< 0.001
e42	↔	e44	-0.087	0.034	-2.565	0.010
e42	↔	e43	0.272	0.044	6.229	< 0.001
e18	↔	e17	0.280	0.043	6.467	< 0.001
e37	↔	e38	0.391	0.047	8.391	< 0.001
e11	↔	e10	0.243	0.034	7.184	< 0.001
e10	↔	e9	0.214	0.033	6.396	< 0.001
e11	↔	e9	0.154	0.027	5.612	< 0.001
e13	↔	e14	0.066	0.019	3.507	< 0.001
e3	↔	e2	0.077	0.030	2.588	0.010
e5	↔	e1	-0.069	0.032	-2.136	0.033
e5	↔	e4	0.165	0.048	3.398	< 0.001
e6	↔	e1	0.107	0.038	2.805	0.005
e7	↔	e4	0.103	0.035	2.948	0.003
e10	↔	e8	0.135	0.030	4.553	< 0.001
e25	↔	e26	0.102	0.039	2.601	0.009
e40	↔	e43	0.258	0.041	6.293	< 0.001
e40	↔	e42	0.114	0.038	3.018	0.003
e4	↔	e3	0.119	0.043	2.752	0.006
e6	↔	e2	0.062	0.030	2.035	0.042

2.4 The Conceptual Model and the Research Hypotheses

Based on EFA and CFA results the conceptual model was created, which is necessary for the determination of the correlations between the factors and the observed variables. The conceptual model (Figure 2) is structured by eight factors, forming three main categories of effects on school mode choice and are related to:

1. The motivation, including objective parameters of parents' motivation to select a specific transport mode (MOTMODE factor), motivation parameters related to the physical and mental health of the student (MOTHEALTH factor), and finally, parameters related to the possibility of using private vehicle for school trips (MOTCAR factor).
2. The parents' mobility patterns, including their shaped perception and attitude regarding the use of the private vehicle (ATTCAR factor), the use of bus (ATTBUS factor), and the use of non-motorized transport modes, namely walking and cycling (ATTWALKBIK factor),
3. The built environment safety, including the neighborhood safety (NEIGBSAF factor) and the route safety (ROUTSAF factor).

What is highlighted in this point, is that the MODE factor has also been extracted from the EFA and confirmed by the CFA, incorporating the choice/preference of parents' school transport mode. This is the factor that forms the core of the conceptual model, the dependent variable.

Based on the conceptual model, the research hypotheses (H) were built, the validity of which was subsequently examined with SEM's development. The main hypotheses considered in the present study are the following:

H1: Do motivation factors affect directly or indirectly the school mode choice?
H2: Do the parents' shaped travel patterns affect directly or indirectly the school mode choice?
H3: Do the built environment safety factors affect directly or indirectly the school mode choice?
H4: Do the exogenous factors affect directly or indirectly the school mode choice?

Given the fact that within the conceptual model, there are three factors expressing motivation (MOTMODE, MOTHEALTH, MOTCAR) and another three expressing the shaped perceptions and attitudes of parents towards motorized and non-motorized transport modes (ATTCAR, ATTBUS, ATTWALKBIK) it will be further examined whether these factors can create second-order factors.

Finally, beyond the four basic hypotheses that were previously posed and will be examined through SEM, any correlations of the factors themselves (latent variables) with each other will be tested.

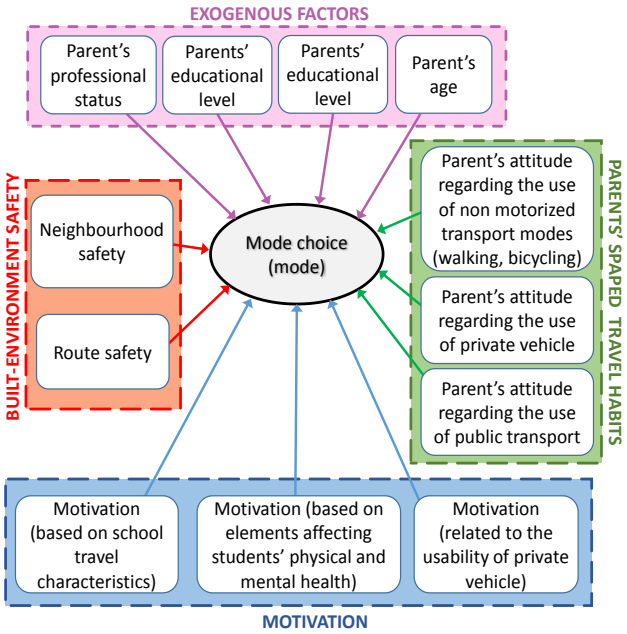

Fig. 2: The conceptual model

3 Structural Equation Model Results and Conclusions

Structural Equation Model (SEM) was evaluated using the maximum likelihood technique, which attempts to estimate the factor model's parameters that are very likely to produce the initial correlation matrix, assuming that the sample conforms with the multivariate normal distribution. The values obtained by the goodness-of-fit indices are the same as those of CFA, proving an adequate SEM. More specifically (values in parentheses show the desired literature values for each indicator, [28], [29]): IFI = 0.91 (≥ 0.90), TLI = 0.90 (≥ 0.90), CFI = 0.91 (≥ 0.90), RMSEA = 0.06 (< 0.08) and X^2 (CMIN/DF) = 2.65 (between 1 and 3).

The model is composed of (Figure 3):

i. The three factors expressing parents' motivation to select the school transport mode (MOTMODE, MOTCAR, MOTHEALTH factors).
ii. Three factors expressing the parent's attitude towards non-motorized modes; walking and bicycling, and motorized modes; car and bus, (factors ATTWALKBIK, ATTCAR, ATTBUS),

iii. Two factors expressing safety (NEIGBSAF, ROUTSAF factors).
iv. The dependent variable (which as emerged from the CFA consists of a separate factor) represents the school mode choice (MODE).

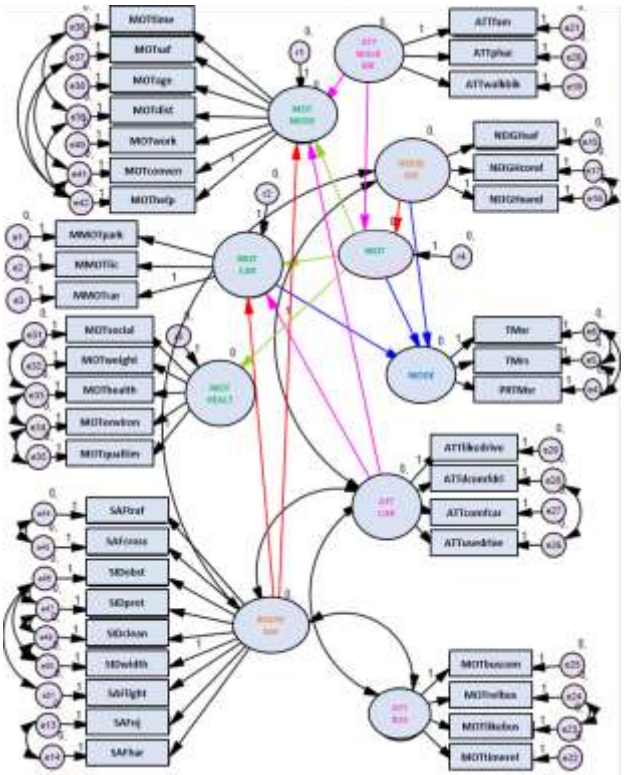

Fig. 3: Graphic depiction of SEM

The developed SEM contains the multi-dimensional element, known as the second-order factor since the three factors of parental motivation (MOTMODE, MOTCAR, and MOTHEALTH) configure the second-order factor MOT. According to SEM's results, all the interrelations between factors and errors are statistically significant ($p < 0.05$). The developed SEM is distinguished by a series of direct and indirect correlations and interrelations between the factors directing to the dependent variable which is the transport mode (MODE).

The main conclusions emerging from SEM's development, and more specifically from the interrelation (denoted as ↔) and the relation (denoted as ←) effect analysis, are the following (Table 3):

- Three factors appear to have an immediate effect on the school mode choice (blue arrows of Fig. 3). The factor representing neighborhood safety (NEIGBSAF), the motivation factor (MOT), and the motivation factor affecting parents on using private vehicles (MOTCAR).
- The remaining variables indirectly affect the dependent variable (MODE), through the three latent variables (MOTMODE, MOTHEALTH, MOTCAR in green circles) that configure the second-order factor (MOT), indicating parental motivation to the mode choice decision. All these effects derive from the latent variables related to parents' attitudes towards the use of private vehicles (ATTCAR), buses (ATTBUS), and alternative transport modes such as walking and bicycle (ATTWALKBIK), as well as the variables representing the safety of the school route the student follows (ROUTSAF) and the safety provided by the neighborhood (NEIGBSAF) the student moves for reaching the school unit.
- The factor representing students' mental and physical health (MOTHEALTH) appears to be inactive, as no other factor seems to affect it. However, its contribution to the configuration of parents' motivation factor (MOT) is important.
- Parents' shaped attitude towards the use of non-motorized transport modes (ATTWALKBIK) has a positive effect (0.303, $p=0.0.2$) on motivation (MOT) representing the positive predisposition of parents for students to walk or bike to and/or from the school unit. At the same time, it has a negative effect (-0.261, $p=0.004$) on MOTMODE, concluding that this positive predisposition is significantly reduced when considering the parameters composing the latent variable MOTMODE, such as student's age, distance to school, student's comfort, travel time, etc.

Table 3. Interrelation (denoted as ↔) and relation (denoted as ←) effect analysis of SEM

			Estimate	Level of significance (p-values)
ATTCAR	↔	ATTBUS	0.303	< 0.001
NEIGBSAF	↔	ROUTESAF	0.447	< 0.001
ATTBUS	↔	ROUTESAF	0.164	< 0.001
NEIGBSAF	↔	ATTCAR	0.147	< 0.001
ATTCAR	↔	ROUTESAF	0.171	< 0.001
MOT	←	NEIGBSAF	-0.460	< 0.001
MOT	←	ATTWALKBIK	0.303	0.002
MOTCAR	←	MOT	0.952	< 0.001
MOTCAR	←	ATTCAR	0.242	< 0.001
MOTCAR	←	ROUTESAF	-0.154	0.012
MODE	←	MOT	-0.263	0.036
MODE	←	NEIGBSAF	-0.761	< 0.001
MODE	←	MOTCAR	0.688	< 0.001
MOTMODE	←	ROUTESAF	-0.152	0.001
MOTMODE	←	ATTCAR	-0.107	0.011
MOTMODE	←	ATTWALKBK	-0.261	0.004
MOTHEALTH	←	MOT	0.871	< 0.001
MOTMODE	←	MOT	0.768	< 0.001

- Parents' shaped attitude towards the use of buses (ATTBUS) does not appear to have any direct effect on any of the other variables, but only a two-way interaction with parents' shaped attitude towards the use of private vehicles due to the comforts offered (ATTCAR) and the feeling of security provided by the sidewalks and the school route the student follows (ROUTSAF). The first two-way relationship (ATTBUS ↔ ATTCAR) presents a high correlation (0.303, p<0.001), indicating on one hand the complementary nature of private vehicle and bus use and on the other the positive attitude of parents towards the use of motorized transport modes. The second two-way relationship (ATTBUS ↔ ROUTSAF) is noticed lower but it is also statistically significant (0.164, p<0.001). This relationship can be interpreted from the fact that the use of the bus for school travel is part of a more complicated process, as it is combined with walking (the student has to walk from the bus stop to the school unit and vice versa, or/and from the residence to the bus stop and vice versa). More specifically, this is the first and last part of the school trip directly linked to the safety of the route the student follows. Therefore, in deciding whether the student will travel by bus or not, the parent has to also consider the factors affecting the safety levels provided by the route the student follows.
- Additionally, observing the set of two-way relationships between the latent variables related to the parents' shaped attitude towards the use of private vehicle and the comforts it offers (ATTCAR) and bus (ATTBUS), and the variables related to the route safety (ROUTSAF) and neighborhood safety (NEIGBSAF), it is clear that these four variables influence each other. At this point, it should be mentioned that the two latent variables representing route safety (ROUTSAF) and neighborhood safety (NEIGBSAF) were found to have a statistically significant correlation (0.447, p<0.001). Even though this correlation presents a high covariance, a new second-order factor could not be configured, most probably due to the absence of one or two additional latent variables that could contribute to the configuration of such a second-order factor.
- A similar inability to configure a second-order factor was presented in all three latent variables related to the parents' shaped attitude towards the use of the motorized transport modes bus and private vehicle (ATTCAR and ATTBUS) and the non-motorized transport modes bicycle and walking (ATTWALKBIK)). Although the first two variables are correlated with statistical significance (0.303, p < 0.001), the variable representing parents' shaped attitude towards the use of non-motorized transport modes does not present any correlation both to the attitude towards motorized modes and the remaining latent variables of the SEM. This can be theoretically interpreted by the fact that these two transport mode options (motorized and non-motorized) are diametrically opposed to configuring two different transport users' categories.
- A significant influence on the factor ATTWALKBIK deriving from at least one of the two factors composing the neighborhood safety (NEIGBSAF and ROUTSAF) was not observed, although this was expected.
- Parents' shaped attitude towards the use of a private vehicle (ATTCAR) has a positive effect (0.242, p<0.001) on the factor depicting the motivation of using a private vehicle (MOTCAR), which in turn has a positive and statistically significant effect (0.392, p<0.001) on the school mode choice (MODE).
- At the same time, the parent's attitude towards the use of a private vehicle (ATTCAR) has a negative effect (-0.107, p=0.011) on the factor consisting of the parameters of parents' motivation to select a transport mode (MOTMODE). This negative effect indicates that the more positive the parents are on using the

private vehicle due to the comfort this offers, the less is the effect of the parameters composing the factor MOTMODE (student's age, school distance, student's comfort, convenience, school travel time, etc.). The positive attitude of parents towards the use of private vehicles leads them to completely ignore or not sufficiently evaluate the observed variables composing MOTMODE. Consequently, parents' shaped attitude towards the use of private vehicles negatively affects part of their motivation in relation to these variables, which, however, are particularly important in the configuration of the latent variable MOT (representing the overall parents' motivation). After all, MOTMODE configures to a large degree MOT based on the comparatively large positive effect noticed (0.768, $p<0.001$).

- Both the parents' shaped attitude towards the use of a private vehicle (ATTCAR) and the factor related to car possession and the ease of finding a parking space close to the residence or the school unit (MOTCAR) appear to contribute negatively to the whole system that tries to interpret the school mode choice process. This negative effect hides that private vehicle ownership and parents' attitude towards its use can motivate the mode choice in favor of private vehicle, leading parents to overlook essential parameters (e.g., distance from residence to school unit, travel time, student's age, etc.). Therefore, it can be well argued that parents who strongly support the use of private vehicles in the school mode choice process tend to ignore the observed variables composing MOTMODE.
- The school route's safety (ROUTSAF) is found to have a negative effect (-0.154, $p=0.012$) on the factor of parental motivation based on private vehicle possession and the ease of finding a parking space close to the residence or the school unit (MOTCAR). This relationship indicates (and at the same time confirms the logical sense) that the greater safety provided by the school route, the less motivated the parent is to use his vehicle.
- Neighborhood safety (NEIGBSAF) seems to be particularly important, as it affects not only the motivation of the parent in general but also directly affects the transport mode choice. Its negative effect on MODE is mainly based on the strongest coefficient noticed in the model (-0.761, $p<0.001$). Dilapidated or damaged buildings, traces of vandalism, and the feeling that the built environment is unsafe seem to negatively affect the mode choice process. This means that parents are essentially obliged to choose the mode that provides the greatest possible security. Therefore, the lower the safety levels, the more a parent tends to use a private vehicle.
- Private vehicle appears to play a strong role in the school mode choice process. Among the three factors that directly affect the transport mode (MODE), the factor MOTMODE has a positive effect (0.688, $p<0.001$), while the two others, NEIGBSAF (-0.761, $p<0.010$) and MOT (-0.263, $p=0.036$), negative. Therefore, the more important car ownership and driving license possession are considered by parents and the less insignificant the restrictions of finding a parking slot close to the residence and the school unit are, the more parents tend to use their private vehicles.

4 Discussion for Further Research

The present study presents perspectives for future additions that could, on one hand, improve the content and the expected result, while, on the other hand, providing answers to other research findings. In this context, the following paragraphs present additional issues to be explored that may lead to an extension of the findings of the present study.

The research was conducted in a Greek urban city, in which policies and interventions that serve the standards and principles of sustainable urban mobility have begun to be adopted and implemented only in recent years and this is the case to a greater or lesser extent in all other Greek cities. The complete lack of appropriate infrastructure or even the inadequacy of existing infrastructure seems to negatively affect the attitude of parents towards the adoption of different travel patterns, thus failing to enhance the use of alternative transport modes. An integrated walking and bicycle network as well as the creation of school rings around the school units, could potentially further reduce the use of private vehicles for school trips completion. Further research could hypothetically focus on the existence of relatively organized infrastructure and examine the intention of parents to select the use of bicycles for school trips (found to be completely limited in the current study), but also to further increase walking even from the first grades of elementary school. The present study showed a superiority of walking (mainly due to the proximity of the school unit to the student's residence), however in most cases the choice of a student "walking alone" mainly concerns older age groups. It would therefore be of scientific interest to examine parents' behaviour, considering the existence of appropriate infrastructure, as beyond the security

provided by such infrastructure, any personal insecurities of parents that are not primarily related to infrastructure but with deeper prejudices and fears, might emerge.

In the current questionnaire survey, parents were asked to evaluate only the quality of services of Thessaloniki's public transport system leaving out the assessment of school buses provided to students by Greek prefectures according to the current legislation. Therefore, the evaluation as formed and reflected by SEM presents a generally negative attitude of parents towards the use of buses. Adding targeted questions to the questionnaire regarding the use of dedicated school buses would probably lead to different results.

The research focused mainly on the urban environment. The incorporation of rural areas would potentially outline different characteristics of school trips and highlight different needs and requirements for improving the school transportation system.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

-Kornilia Maria Kotoula carried out the literature review (section 1) and conducted the questionnaire survey (sub-section 2.1).
-Kornilia Maria Kotoula and George Botzoris were responsible for the factor analysis deployment (sub-sections 2.2, 2.3, and 2.4), SEM's development (section 3), and discussion for further research (section 4).

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Conflict of Interest

The authors have no conflict of interest to declare.