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Perceptions of Parents of the Quality of the Public Transport Services Used by Children to Commute to School

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Abstract: The risk of accidents is a danger in public transport that could lead to threats to property, the environment, and the lives and health of people. In particular, parents are keenly aware of and concerned about the safety of school trips. Thus, this study aims to examine the factors that influence the perceptions of parents about the safety of the school trips of children. The study recruited 750 respondents from Northeast Thailand. Data were obtained from responses to a self-report questionnaire. The model consisted of six factors, namely, transportation satisfaction, infrastructure, information, the safe behavior of drivers, the safety of the transportation systems, and the safety policy. The results of the confirmatory factor analysis indicated that all six factors were in accordance with the empirical data (model fit statistic: χ^2 = 758.098, df = 276, χ^2/df = 2.747, CFI = 0.962, TLI = 0.955, SRMR = 0.038, RMSEA = 0.048). The results can serve as a reference for developing guidelines and recommending policies for the management and the implementation of safe school trips for students.

Keywords: school zone; perceived service quality; safety; third-order confirmatory factor analysis

Citation: Jomnonkwao, S.; Banyong, C.; Nanthawong, S.; Janhuaton, T.; Ratanavaraha, V.; Champahom, T.; Jongkol, P. Perceptions of Parents of the Quality of the Public Transport Services Used by Children to Commute to School. *Sustainability* **2022**, *14*, 13005. https://doi.org/10.3390/su142013005

Academic Editors: Kyandoghere Kyamakya, Jacek Oskarbski and Miroslava Mikušová

Received: 10 September 2022
Accepted: 6 October 2022
Published: 11 October 2022

1. Introduction

One of society's major concerns in Thailand is the school commute, a critical topic for households with students. In many countries worldwide, students frequently drive their own cars to school, for example, see Queiroz, et al. [1]; this increase in the overall number of cars results in school areas being congested with vehicles, a common scenario in Thailand's urban areas. This usually occurs at peak times at the start and end of a school day. School buses and cars are the most common modes of transport for children to and from school [2]. Even though students are at risk of accidents, the Road Safety Thailand Road Safety Policy Foundation [3] reported that students are approved to use a private vehicle to travel to school because of the ease of travel, reduced time pressure [4–7], and the perceived safety of parents in traveling to and from school [8–11]. Parents are worried about the safety of children traveling to school due to the increasing number of traffic incidents. In 2020, the death rate due to road accidents was 2720 per 100,000 people, with the highest rate among children and young adults aged 10 to 24 years [12]. The Public Health Statistics [13] reported that Thai children aged less than 15 years die from injuries sustained on the roads at a rate of 93.7 deaths per 100,000 people.

This situation demonstrates the importance of public transportation as an essential component of urban infrastructure that helps people move around and supports the economy [14]. Previous studies, such as those conducted by Dianat, et al. [15], Quiñonez,

et al. [16], Prasad and Maitra [17] provide evidence that the commute to school affects the overall student efficiency at school. However, public transport to school, especially for students, has not been studied in developing countries [15]. Previous studies have addressed school excursions on sightseeing tour buses in Thailand [18,19], However, taking a tour bus for excursions or sightseeing is a non-routine activity that is different from using public transport for commuting between home and school.

The majority of the previous research on the quality of the transportation services and the safety of public transportation [14,20,21] has focused on the transportation of adults more than youth [22,23]. The travel behavior of children differs from that of adults [24]. Thus, there are few studies that highlight the travel modes of children and their well-being [23,25]. Parental perception, in particular, is critical in determining the mode of transportation, particularly in terms of security. This is due to the fact that the risk associated with public transportation is increasing, which could endanger lives, the environment, personal property, and human health [26]. The safety of public transport pertains not only to the safety of the equipment or handling associated with the transportation but also to the trust of passengers and personnel in terms of the external influences on the safety of the public transport [2,27,28]. Parents are worried about the safety of children traveling to school; the statistics for Thailand in 2019 show that 401 public transport vehicles were involved in accidents [29]. The occurrence of public transport accidents often leads to a lack of confidence in the service quality and safety. Previous studies addressing public transport users [30–32] have shown that the perception of the quality of the different service attributes influences their levels of satisfaction, and it is this satisfaction that influences their use of public transport. If parents express safety concerns, then these concerns can be passed on to children, which could lead to disruptive behavior at school [33,34].

Factors that influence the perceived safety of parents and the satisfaction of children are dependent on the social environment and travel behavior [35–37]. Several modes of transportation to school are available for children, such as motorcycles, private cars, public buses, personal rental cars, and school buses. The study proposes the management of public transportation as a strategy for addressing issues with and improving sustainable transport [38], such as public buses, private rental automobiles, and school transportation. However, using public transportation is one of the activities that causes parents to worry about the safety of their children. In order to support the use of public transport, it is important to understand parental safety perceptions and to establish or improve the safety standards of the public transport on the commute to school. The results could encourage operators to improve the quality of service, maintenance of vehicles, and the quality and driving behavior of drivers. At the same time, the results could promote safety standards for children, their parents, and teachers during commuting. The main goal of the public bus policy is to attract more passengers to use buses instead of cars by improving the quality of buses and services and ultimately reducing traffic congestion.

Therefore, this study aims (1) to examine the factors that influence the perceptions of parents about safety in order to develop guidelines for the management of school transportation and to develop a model for measuring the quality of school and public buses and (2) to recommend policies for ensuring the safety of children on school trips. To answer the above aims, this study applied third-order confirmatory factor analysis to model an objective response, which has not been previously conducted in similar research.

2. Literature Review

2.1. Conceptualization of the Effect of Parenting Styles on Children's Risk Perceptions on Roads

There is evidence that parenting styles affect children's perceptions of the risk of travel. In other words, children tend to imitate the behavior of their parents by following their choices and attitudes [1]. It is therefore expected that if parents are aware of the impact of the perceived risks on the road, this can improve their children's perceptions of risk. However, the results have indicated that parents' perceptions of traffic risk were not significantly related to children's perceptions of risk [39]. Parents' perceived safety

in transport operations and services affects parents' trust in their children's solo travel on public transportation as well as the latent concerns related to "operation service". For example, frequency and schedule greatly affect the willingness to switch to public transport on school trips [1]. In addition, parents' perceptions of safety in their children's travel to school are influenced by age, income, and social cohesion, as well as the quality of the infrastructure [40].

2.2. Measurement of the Perception of Transport Users of the Quality of Public Transportation

According to previous studies, Morton, et al. [41] used exploratory factor analysis (EFA) to classify relevant indicators and confirmatory factor analysis (CFA) to verify the consistency of the grouping of indicators with the empirical data in a study on the perception of transport users of the quality of public transportation. The related factors included comfort, convenience, punctuality, and access to information. The current study investigated the factors that influence the perceptions of parents about the safety of the school trips of children. The factors expected to improve safety and convenience in travel can also be used to formulate guidelines for the safety management of school trips for students and to recommend policies for the safety of school travel for students. Therefore, six factors were applied as follows:

2.2.1. Transportation

The awareness of parents about the safety of school trips is a factor related to the indicators in terms of selecting the mode of public transport for school trips, such as access to school transportation services, school commute facilities, and planned schedule management. The majority of studies that focus on the factors of service availability cite that the availability of routes and clearly stated schedules of services exerted a significant influence on the perceptions of the quality of the public transport services [41–47]. Moreover, travel time exerts a negative influence on user satisfaction [48].

2.2.2. Infrastructure

The service infrastructure of the public transport for schools is an extremely important factor for education, because consumers mainly pay attention to infrastructure when selecting a mode of transport. In addition, it exerts a positive influence on the perceived quality of the public transport services [41,44,45,47]. A factor related to the indicators of infrastructure is comfort at bus stops, such as having a roof to protect commuters from rain, sufficient lighting, cleanliness, and sufficient seats for waiting. Previous studies confirm that the convenience of access to public bus stops exerted a statistically significant effect on the satisfaction of users of public transport.

2.2.3. Information

Public bus operators should prioritize travel information services to increase the positive perceptions of consumers about the service quality [46]. Public transportation systems that introduce technology systems to facilitate travel information services can respond immediately to travel planning, including the establishment of an information center to cater to questions and for public relations. Regarding public transport to schools, numerous studies find that a service that is comprehensive, accurate, up-to-date, and capable of meeting the needs of users is a factor that influences the perception of the quality of the service. Moreover, the studies cite that the overall service of public transport was statistically significant [41–44,49].

2.2.4. Safety Behavior of Drivers

On the road, drivers should avoid behaviors that lead to risk and harm for themselves and others. For example, van Lierop and El-Geneidy [49] identified driver behavior as the most influential factor on road safety. Tao, et al. [50] confirmed that traffic violations, vehicle speeding, texting and phone use, intoxication, and sudden lane changes

exert a positive influence on the risk of accidents. These risky driving behaviors directly influence the perceived quality of the service [44,46,47,51] and positively influence user satisfaction [42,52,53].

2.2.5. Safety of Transportation Systems

Procedures for safety among public bus drivers, such as using the left lane for picking up passengers, parking at designated points or places in safe areas, and driving assigned routes to pick up and drop off students were significantly positively correlated with perceived safety [52] and influenced satisfaction with the safety of using the public transport services [49].

2.2.6. Safety Policy

Perceived safety and stability while using public transport directly influence passenger loyalty [52] and are factors that influence the perception of the quality of the public transport services [41,45,47,49]. The importance of the perceived quality of services in terms of the perceived safety inside vehicles influences the satisfaction of selecting a mode of public transport [42,43].

Table 1 shows previous studies on the quality of the service and the safety of public transport. There are numerous studies on children's school trips, mainly focusing on demographics [54], socioeconomics [55], barriers to using public transport to school [56–58], driver personality [59,60], and environmental awareness [61]. In a study to assess the quality of public transport, [18,62–64] studied the satisfaction and loyalty of the use of tour buses for field trips, on a study of tour drivers in a business context. Ratanavaraha and Jomnonkwao [19] studied the problems of bus drivers. In addition, Zhang, et al. [65] focused on vehicle problems; however, each study had different research questions based on its objectives. This study highlights the perceptions of parents influencing schoolchildren's decisions about the school commute [66], including the service and safety, in order to create strong policy in developing countries [67]. In particular, we focus on the issue of child safety when commuting to school. This study is urgently needed as an effort to advance safe education for children.

Table 1. Literature review and relevant research.

Authors (Year)	Methodology	Perceived Service Quality					
		Transportation	Infrastructure	Information	Safe Behavior of Driver	Safety of Transportation Systems	Safety Policy
dell'Olio, Ibeas and Cecín [45]	Ordered probit model	√	√	-	-	-	√
de Oña, de Oña, Eboli and Mazzulla [44]	Structural equation modeling	√	√	√	√	-	-
Guirao, García-Pastor and López-Lambas [46]	Factorial analysis, multiple regression analysis, and multiple indicators multiple causes (MIMIC) models	√	-	√	-	-	-
Morton, Caulfield and Anable [41]	Confirmatory factor analysis	√	√	√	-	-	√
van Lierop and El-Geneidy [49]	Structural equation modeling	-	-	√	√	√	√
Abenoza, Cats and Susilo [42]	Logistic regression analysis	√	√	√	√		√
Westman, Olsson, Gärling and Friman [48]	Multivariate analyses of variance (MANOVAs) and analyses of variance (ANOVAs)	√	-	-	-	-	-
Tao, Zhang and Qu [50]	Structural equation modeling	-	-	-	√	-	-
Allen, Muñoz and de Dios Ortúzar [51]	Structural equation modeling and MIMIC models	-	√	-	√	-	-
Choi, Ko and Kim [43]	Ordered probit model	-	-	-	-	-	√
Nguyen-Phuoc, Phuong Tran, Nguyen, Le and Su [52]	Partial least square and structural equation modeling	-	-	-	√	√	√
Olowosegun, Moyo and Gopinath [47]	Multi criteria-based approach	√	√	-	√	-	√
Tanglai, Chen, Rattanapan and Laosee [53]	Hierarchical regression model	-	-	-	√	-	-

Note: √ means that variables were used in the studies; - means that variables were not used in the studies.

3. Materials and Methods

3.1. Participants and Data Collection

The questionnaire consisted of three main sections, namely, socioeconomic data, school commute environment, and information on the vehicle condition, with a total of 47 questions. For the CFA, the maximum likelihood estimation requires approximately 15 times the number of samples (or 750 samples); [68]. Therefore, data for this study were derived from 750 self-report questionnaires, and the measurement model for the safety management of school travel in Northeast Thailand was analyzed. The first part of the questionnaire pertained to parent information, and second part was student information. Data obtained from the survey are shown in Table 2.

Table 2. Primary characteristics of the respondents.

Category	Detail	Frequency	Valid Percent
Sex (Parent)	Male	337	44.90
	Female	413	55.10
Marital status (Parent)	Single	27	3.60
	Married	540	72.00
	Other	183	24.40
Education (Parent)	Primary school	95	12.70
	Secondary school	179	23.90
	High school	245	32.70
	Diploma/High vocational certificate	128	17.10
	Bachelor's degree and above	100	13.30
	Other	3	0.4
Profession (Parent)	Government/state enterprise	68	9.10
	Private company	152	20.30
	Own business/trade	166	22.10
	Farmer	57	7.60
	General employee	280	37.30
	Butler/housekeeper	18	2.40
	Other	9	1.20
Own vehicle (Parent)	None	69	9.20
	Motorcycle	357	47.60
	Personal car	177	23.60
	Other	147	19.60
Driving license (Parent)	None	148	19.70
	Personal car	505	67.30
	Motorcycle	22	2.90
	Car and motorcycle	75	10.00
Sex (Child)	Male	368	49.10
	Female	382	50.90
Education (Child)	Primary school	395	52.70
	Secondary school	222	29.60
	High school	133	17.70
Transport mode (Child)	Personal car	113	15.10
	Motorcycle	302	40.30
	School bus	78	10.40
	Public bus	215	28.70
	Other	42	5.60
	Male	368	49.10

Note: Average age of parents: 40 years; average age of students: 13 years; average personal income of parents = 11,817 THB/month; average household income = 23,876 THB/month.

The third part consisted of 26 items, which were related to the quality of the public transport services (school trips) for students, which were classified into six groups, namely,

transportation (six items), infrastructure (six items), information (three items), driver safety behavior (four items), transportation safety system (three items), and safety policy (four items). The factors were categorized into six components (i.e., transportation, infrastructure, information, the safe behavior of drivers, the safety of the transportation systems, and the safety policy, as shown in Table 3.

Table 3. Description of each indicator.

Code	Variables	References
Trans	**Transportation**	
S1	There are services or facilities to use public transport to travel to school.	[20,69,70]
S2	There is a regular public transport service that connects to the school.	[20,69,70]
S3	In the area, various types of public transport can be selected for commuting to school (e.g., school buses, vans, and public buses).	[20,69–71]
S4	Traveling by public transportation to school is convenient and fast.	[20,70,72]
S5	Traveling by public transportation to school follows the planned time.	[70,73–75]
S6	Traveling by public transport to school gives freedom and flexibility to plan.	[20,70,76]
Infra	**Infrastructure**	
S7	You can easily access public transport.	[20,70]
S8	There are signs clearly indicating the entry points to public transport services for users.	[77,78]
S9	Public transport has a clear route for service.	[77,78]
S10	Public transport has a clear schedule.	[72,77,78]
S11	Public transport terminals are clean and well-equipped (with roof, lighting, and adequate seating).	[17,20,75,79,80]
S12	The school has sufficient public transport stops.	[69,81]
Inform	**Information**	
S13	There is an information center to provide accurate and clear answers to questions about public transport to school.	[20,70,82]
S14	There is information about traveling to school by public transport and service points, and the routes are clear and easy to understand.	[20,69,70,72,82]
S15	There is an application to recommend the use of transportation systems, presenting accurate and up-to-date information that can respond to travel planning.	[72,82]
Safety1	**Safe behavior of drivers**	
S16	Public transport drivers observe speeds appropriate to the route and the environment without risk.	[14,83–85]
S17	Public transport drivers do not use phones or other communication devices while driving.	[85–87]
S18	Public transport drivers do not smoke, use intoxicants, or any narcotics while driving.	[18,19,88]
S19	Public transport drivers do not suddenly change lanes.	[83,89,90]
Safety2	**Safety of transportation systems**	
S20	Public transport always uses the left lane to pick up passengers.	[14,91]
S21	Public transportation stops at a safe spot. When parking on the road and picking up passengers, drivers always park on the left side.	[14,91]
S22	Public transport drivers do not drive off the road, except for emergencies or necessities.	[85,90]
Safety3	**Safety policy**	
S23	The staff check that the students are orderly (sitting or getting out of the car) before leaving the car.	[71–73,90]
S24	Public transport has equipment to prevent accidents, such as falling from the car.	[18,92–94]
S25	When traveling to school by public transportation, you can secure your belongings from theft.	[20,69,70,72]
S26	Traveling to school by public transport is safe from accidents.	[20,69,82,95]

Note: The latent variables were bold.

3.2. Data Analysis

First, the study analyzed the descriptive statistics to examine the normal distribution of data using the mean, standard deviation (SD), skewness, and kurtosis. We then used the EFA and principal component analysis (PCA) to group the observed indicators. We introduced the results of the EFA into the CFA to verify the hypothesis. As the composition was complex, this study conducted third-order CFA to gain a deeper understanding of which of the factors were important to transport policy.

3.2.1. Exploratory Factor Analysis (EFA)

This study conducted the EFA using SPSS to find the component variables and PCA to identify the components of a variable. PCA aims to explore the number of components that can be substituted for all variables. In other words, it extracts details from variables into

components to reduce the number of variables. For axis rotation, the study used the varimax rotation, which is used to maximize the sum of variances between components, resulting in a clear separation of components and the determination of a highly structured and unique element and leading to a convenient interpretation of components (Little Diamond, 2005). Subcomponents with factor loadings more than 0.5 were considered statistically significant, and each component was composed of no less than three subcomponents [96] with eigen values greater than 1 [97].

3.2.2. Reliability of the Research Instrument

The validity of the research instrument can be verified through construct reliability (CR) and average variance extracted (AVE), which were derived using Equations (1) and (2), respectively:

$$CR = \frac{(\sum_{i=1}^{n} \beta_i)^2}{(\sum_{i=1}^{n} \beta_i)^2 + (\sum_{i=1}^{n} \delta_i)^2} \quad (1)$$

$$AVE = \frac{(\sum_{i=1}^{n} \beta_i)^2}{n} \quad (2)$$

where β denotes factor loading, δ represents error variance, and n pertains to the number of elements considered.

3.2.3. Confirmatory Factor Analysis (CFA)

CFA is a maximum likelihood estimation used to test the consistency of models using empirical data from road safety policy. The recommended criteria for determining the conformity of the hypothetical model to the empirical data for CFA are as follows: the chi-square/df (χ^2/df) should be less than 5 [98]; the comparative fit index (CFI) should be greater than 0.95 Hu and Bentler [99]; the Tucker–Lewis index (TLI) should be greater than 0.8 [100]; the root mean square error of approximation (RMSEA) should less than or equal to 0.08 [101]; and the standardized root mean square residual (SRMR), according to Hu and Bentler [99], should be less than or equal to 0.08. Table 4 provides the details of the model fit indices.

Table 4. Cutoff values of the model fit indices.

Model Fit Index	Cutoff Value	References
Chi-square/degree of freedom	<5	Wheaton, Muthén, Alwin and Summers [98]
Standardized root mean square residual (SRMR)	≤0.08	Hu and Bentler [99]
Root mean square of approximation (RMSEA)	≤0.07	Steiger [102]
Comparative fit index (CFI)	≥0.90	Hu and Bentler [99]
Tucker–Lewis index (TLI)	≥0.80	Hooper, Coughlan and R. Mullen [100]

4. Results

4.1. Descriptive Statistics

The basic statistical values used in the analysis to determine the distribution were the mean, SD, skewness, kurtosis, and the correlation between variables. The factors were categorized into six components (i.e., transportation, infrastructure, information, the safe behavior of drivers, the safety of the transportation systems, and the safety policy). Table 5 provides the results. The skewness and kurtosis can represent the normal frequency distribution of the data. The optimum skewness ranges from −2 to 2, and the optimum luminance ranges from −7 to 7. It can be concluded that the data had a normal distribution [103–105], as the analysis showed that the skewness of all variables was between −0.33 and 0.13, and the kurtosis ranged from −0.93 to −0.48. All data used in the analysis were within acceptable limits or had a normal distribution and were suitable for further analysis.

Table 5. Descriptive statistics of each indicator.

Code	Variable	Mean	SD	Skewness	Kurtosis
Trans	**Transportation**				
S1	There are services or facilities to use public transport to travel to school.	2.83	1.15	−0.01	−0.76
S2	There is a regular public transport service that connects to the school.	2.89	1.18	0.00	−0.81
S3	In the area, various types of public transport can be selected for commuting to school (e.g., school buses, vans, and public buses).	2.80	1.22	0.11	−0.93
S4	Traveling by public transportation to school is convenient and fast.	2.86	1.16	0.02	−0.71
S5	Traveling by public transportation to school follows the planned time.	2.92	1.16	−0.07	−0.75
S6	Traveling by public transport to school gives freedom and flexibility to plan.	2.85	1.15	0.06	−0.73
Infra	**Infrastructure**				
S7	You can easily access public transport.	2.96	1.17	−0.08	−0.75
S8	There are signs clearly indicating the entry points to public transport services for users.	2.92	1.13	−0.03	−0.67
S9	Public transport has a clear route for service.	3.05	1.16	−0.20	−0.68
S10	Public transport has a clear schedule.	2.87	1.13	−0.03	−0.71
S11	Public transport terminals are clean and well-equipped (with a roof, lighting, and adequate seating).	2.87	1.11	−0.01	−0.56
S12	The school has sufficient public transport stops.	2.96	1.11	−0.10	−0.63
Inform	**Information**				
S13	There is an information center to provide accurate and clear answers to questions about public transport to school.	2.73	1.11	0.13	−0.57
S14	There is information about traveling to school by public transport and service points, and the routes are clear and easy to understand.	2.75	1.12	0.13	−0.58
S15	There is an application to recommend the use of transportation systems, presenting accurate and up-to-date information that can respond to travel planning.	2.67	1.16	0.10	−0.78
Safety1	**Safe behavior of drivers**				
S16	Public transport drivers observe speeds appropriate to the route and the environment without risk.	3.00	1.09	−0.09	−0.48
S17	Public transport drivers do not use phones or other communication devices while driving.	3.09	1.12	−0.27	−0.53
S18	Public transport drivers do not smoke, use intoxicants, or any narcotics while driving.	3.11	1.16	−0.23	−0.73
S19	Public transport drivers do not suddenly change lanes.	3.10	1.11	−0.33	−0.56
Safety2	**Safety of transportation systems**				
S20	Public transport always uses the left lane to pick up passengers.	3.10	1.10	−0.16	−0.59
S21	Public transportation stops at a safe spot. When parking on the road and picking up passengers, drivers always park on the left side.	3.12	1.13	−0.27	−0.67
S22	Public transport drivers do not drive off the road, except for emergencies or necessities.	3.12	1.17	−0.23	−0.79
Safety3	**Safety policy**				
S23	The staff check that the students are orderly (sitting or getting out of the car) before leaving the car.	2.99	1.09	−0.16	−0.60
S24	Public transport has equipment to prevent accidents, such as falling from the car.	2.95	1.11	−0.13	−0.69
S25	When traveling to school by public transportation, you can secure your belongings from theft.	3.05	1.14	−0.28	−0.67
S26	Traveling to school by public transport is safe from accidents.	3.04	1.19	−0.23	−0.80

Note: The latent variables were bold.

For the correlation coefficient analysis between variables [106], the correlation coefficient should be between 0.3 and 0.8 to avoid multicollinearity problems [107,108]. The variables in this study were found to have a correlation coefficient of 26 variables between 0.39 and 0.69, as shown in Table 6. Therefore, it can be concluded that the variables used in the study did not show multicollinearity.

4.2. Results of the EFA

To determine the composition of a variable (orthogonal axis rotation using varimax rotation and the Kaiser normalization method), the elements identified through the PCA with weights less than 0.5 were excluded [97]. Moreover, the correlation of the indicators for each component must not be less than three items [96]. An element with an eigenvalue greater than 1 indicates that it can be used for factor analysis. EFA is an exploratory technique instead of a reference statistic. Therefore, the results obtained from the EFA were used in the CFA to verify the validity of the hypothesis.

Table 6. Results of the correlation coefficient between variables.

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26
S1	1.00																									
S2	0.63	1.00																								
S3	0.68	0.67	1.00																							
S4	0.56	0.56	0.64	1.00																						
S5	0.59	0.56	0.58	0.60	1.00																					
S6	0.52	0.55	0.63	0.60	0.59	1.00																				
S7	0.50	0.52	0.46	0.54	0.52	0.49	1.00																			
S8	0.54	0.51	0.50	0.56	0.50	0.46	0.63	1.00																		
S9	0.46	0.47	0.42	0.50	0.49	0.44	0.66	0.59	1.00																	
S10	0.45	0.43	0.39	0.46	0.45	0.49	0.55	0.58	0.62	1.00																
S11	0.48	0.51	0.50	0.51	0.55	0.52	0.52	0.54	0.53	0.56	1.00															
S12	0.45	0.47	0.42	0.50	0.52	0.47	0.56	0.56	0.57	0.57	0.60	1.00														
S13	0.49	0.43	0.48	0.48	0.49	0.55	0.49	0.49	0.40	0.47	0.54	0.51	1.00													
S14	0.47	0.49	0.49	0.50	0.52	0.50	0.49	0.53	0.44	0.52	0.55	0.53	0.66	1.00												
S15	0.47	0.40	0.52	0.50	0.49	0.53	0.41	0.47	0.34	0.44	0.48	0.45	0.66	0.64	1.00											
S16	0.36	0.36	0.37	0.43	0.36	0.37	0.47	0.44	0.42	0.35	0.39	0.39	0.42	0.45	0.39	1.00										
S17	0.32	0.34	0.30	0.39	0.38	0.31	0.47	0.44	0.46	0.36	0.37	0.36	0.35	0.37	0.32	0.48	1.00									
S18	0.33	0.33	0.33	0.43	0.38	0.35	0.49	0.42	0.49	0.38	0.39	0.43	0.34	0.39	0.32	0.49	0.67	1.00								
S19	0.31	0.34	0.31	0.42	0.40	0.37	0.46	0.43	0.41	0.39	0.44	0.39	0.35	0.39	0.33	0.44	0.46	0.50	1.00							
S20	0.33	0.28	0.32	0.38	0.36	0.35	0.44	0.39	0.42	0.38	0.36	0.35	0.41	0.35	0.35	0.63	0.43	0.42	0.43	1.00						
S21	0.32	0.30	0.30	0.45	0.36	0.34	0.41	0.37	0.39	0.41	0.31	0.32	0.32	0.35	0.32	0.60	0.39	0.45	0.46	0.64	1.00					
S22	0.35	0.33	0.29	0.36	0.35	0.31	0.52	0.42	0.51	0.38	0.36	0.45	0.35	0.35	0.28	0.43	0.63	0.62	0.41	0.45	0.50	1.00				
S23	0.32	0.24	0.31	0.41	0.36	0.34	0.40	0.41	0.42	0.35	0.37	0.35	0.34	0.37	0.34	0.62	0.41	0.47	0.46	0.57	0.67	0.48	1.00			
S24	0.32	0.32	0.28	0.40	0.38	0.36	0.42	0.42	0.47	0.44	0.44	0.40	0.32	0.38	0.27	0.35	0.37	0.43	0.60	0.42	0.48	0.49	0.46	1.00		
S25	0.35	0.33	0.32	0.42	0.41	0.38	0.52	0.47	0.49	0.47	0.46	0.46	0.36	0.39	0.28	0.45	0.46	0.47	0.66	0.49	0.52	0.54	0.55	0.69	1.00	
S26	0.39	0.41	0.42	0.49	0.44	0.43	0.54	0.47	0.53	0.46	0.48	0.49	0.42	0.45	0.35	0.44	0.45	0.52	0.58	0.40	0.47	0.50	0.44	0.61	0.66	1.00

4.2.1. Primary Statistics of the Variables Used in the EFA

The basic statistical values used in the analysis to determine the distribution of the data used in the EFA were the mean, SD, skewness, kurtosis, and correlation between variables. The factors were categorized into six components (i.e., transportation, infrastructure, information, the safe behavior of drivers, the safety of the transportation systems, and the safety policy). Table 7 provides the results.

4.2.2. Extraction Results of the EFA

The results of the 26 variables analyzed using the EFA revealed six components (i.e., transportation, infrastructure, information, the safe behavior of drivers, the safety of the transportation systems, and the safety policy), which accounted for 67.652% of the total variance (Table 7).

Transportation (component 1; S1−S6) accounted for 45.52% of the total variance, which consisted of six variables. Infrastructure (component 2; S7−S12) accounted for 7.639% of the total variance. The third component was the safe behavior of drivers (component 3; S13−S15) and accounted for 4.348% of the total variance. The safety policy (S16−S19) was the fourth component and accounted for 3.578% of the total variance. The fifth element was information and accounted for 3.433% of the total variance (S20−S22). The last element (the safety of the transportation systems; S23−S26) accounted for 3.137% of the total variance.

4.2.3. Validity and Reliability Tests of the Questionnaire

The study employed the Kaiser–Meyer–Olkin (KMO) and Bartlett's test of sphericity (Table 8) to validate the factor analysis. The KMO values were used to determine the suitability of the sample size, which should not be less than 0.8 [109]. Bartlett's test of sphericity was used to examine the population correlation metrics (identity matrix). The null hypothesis of this test is that the population correlation metric is the identity metric. Therefore, the variables must be classified, such that the significance element of this test

should be less than 0.05. In this study, the calculated KMO value of the sample was 0.963, which confirmed that data were suitable for factor analysis. Additionally, a significance level of less than 0.001 was reached using Bartlett's test, which should be less than 0.01. This finding suggests that the correlation metric was not an indicative identity metric. The fact that the variables were related indicates that the data can be used for EFA.

Table 7. Extraction results of the exploratory factor analysis.

Code	Component					
	1	**2**	**3**	**4**	**5**	**6**
S3	0.816					
S2	0.724					
S1	0.722					
S4	0.660					
S6	0.633					
S5	0.627					
S10		0.708				
S9		0.693				
S12		0.593				
S8		0.591				
S7		0.567				
S11		0.459				
S17			0.759			
S18			0.748			
S19			0.717			
S16			0.698			
S24				0.765		
S25				0.739		
S23				0.716		
S26				0.642		
S15					0.734	
S13					0.709	
S14					0.631	
S20						0.795
S21						0.731
S22						0.644
Eigenvalue	14.565	2.444	1.391	1.145	1.099	1.004
% of variance	45.517	7.639	4.348	3.578	3.433	3.137
Cumulative %	45.517	53.155	57.504	61.082	64.515	67.652

Table 8. Results of the KMO and Bartlett's Test.

Parameters		**Value**
Kaiser–Meyer–Olkin Measure of Sampling Adequacy		0.963
Bartlett's Test of Sphericity:	Approx. Chi-Square	17437.927
	df	561
	Sig.	<0.001

4.2.4. Internal Consistency Reliability

Data from the questionnaire were checked for internal consistency reliability using Cronbach's alpha, which ranges from 0 to 1. The current study obtained Cronbach's alpha values greater than 0.7 [110], and the descriptive statistics of the data from the questionnaire responses in Table 9 indicate the statistical values describing the distribution characteristics, namely, the skewness ranged from −0.20 to 0.02, and the kurtosis ranged from −0.66 to −0.79, indicating normal distribution.

Table 9. Cronbach's alpha for subscales.

Factors/Indicators	Items	Cronbach's Alpha	Min.	Max.	Mean	SD	SK	KU
PSQ	26	0.955						
Transportation	6	0.899	1	5	2.86	1.17	0.02	−0.79
Infrastructure	6	0.891	1	5	2.94	1.14	−0.07	−0.68
Information	3	0.851	1	5	2.72	1.13	0.11	−0.65
Safety behavior of drivers	4	0.867	1	5	3.08	1.12	−0.22	−0.66
Safety of transportation systems	3	0.843	1	5	3.11	1.14	−0.22	−0.69
Safety policy	4	0.881	1	5	3.01	1.13	−0.2	−0.7

Note: SD = standard deviation; SK = skewness; KU = kurtosis.

4.3. Results of the Third-Order CFA

The results of the third-order CFA, shown in Table 10, demonstrated that each component was positively correlated and statistically significant at the 0.01 level, including the three safety components (the safety of the transportation systems, the safety policy, and the safe behavior of drivers). In other words, these factors are important indicators for determining the safety of public transportation. In addition, the results implied that the satisfaction of parents with transportation, infrastructure, information, and safety are important indicators to consider in determining their perception of the quality of the public transport services used by their children to commute to school. When considering the factor loading of the components, the study found that infrastructure had a factor loading of 0.973, which was the highest value, followed by transport (0.871), information (0.833), and safety (0.816). In terms of the subcomponents of the safety factor, the study observed that safety policy was the most influential factor (0.894), followed by the safety of the transportation system (0.844), and the safe behavior of drivers (0.815).

Table 10. Results of the third-order CFA on the satisfaction of parents with the service quality of the public transportation to school.

Factor	Code	Beta	*p*-Value	CR	AVE
Transportation	S1	0.763	<0.001	0.897	0.592
	S2	0.746	<0.001		
	S3	0.784	<0.001		
	S4	0.780	<0.001		
	S5	0.777	<0.001		
	S6	0.767	<0.001		
Infrastructure	S7	0.781	<0.001	0.888	0.570
	S8	0.771	<0.001		
	S9	0.728	<0.001		
	S10	0.734	<0.001		
	S11	0.763	<0.001		
	S12	0.750	<0.001		
Information	S13	0.817	<0.001	0.849	0.652
	S14	0.829	<0.001		
	S15	0.776	<0.001		
Safety1: Safe behavior of drivers	S16	0.772	<0.001	0.875	0.636
	S17	0.796	<0.001		
	S18	0.804	<0.001		
	S19	0.818	<0.001		
Safety2: Safety of the transportation systems	S20	0.795	<0.001	0.844	0.644
	S21	0.816	<0.001		
	S22	0.796	<0.001		
Safety3: Safety policy	S23	0.813	<0.001	0.883	0.654
	S24	0.774	<0.001		
	S25	0.861	<0.001		
	S26	0.783	<0.001		

In addition, Table 10 presents the results of the questionnaire validation. For the CR, the factor confidence should be greater than 0.7 [97], and the mean AVE should be greater

than 0.5 [111]. In this study, the CR and AVE values ranged from 0.844 to 0.897 and from 0.570 to 0.654, respectively, which met the recommended values.

Figure 1 depicts the results of the CFA on the perceptions of parents regarding the service quality of the public transport for the school trips of their children, which include transportation, infrastructure, information, the safe behavior of drivers, the safety policy, and the safety of the transportation systems. Parental satisfaction, which was related to three safety factors, was classified as a safety factor. The results revealed that the CFA results were consistent with the empirical data (goodness-of-fit statistics: χ^2 = 758.098, df = 276, χ^2/df = 2.747, CFI = 0.962, TLI = 0.955, SRMR = 0.038, RMSEA = 0.048, * $p < 0.05$, ** $p < 0.01$). Table 11 presents the statistics.

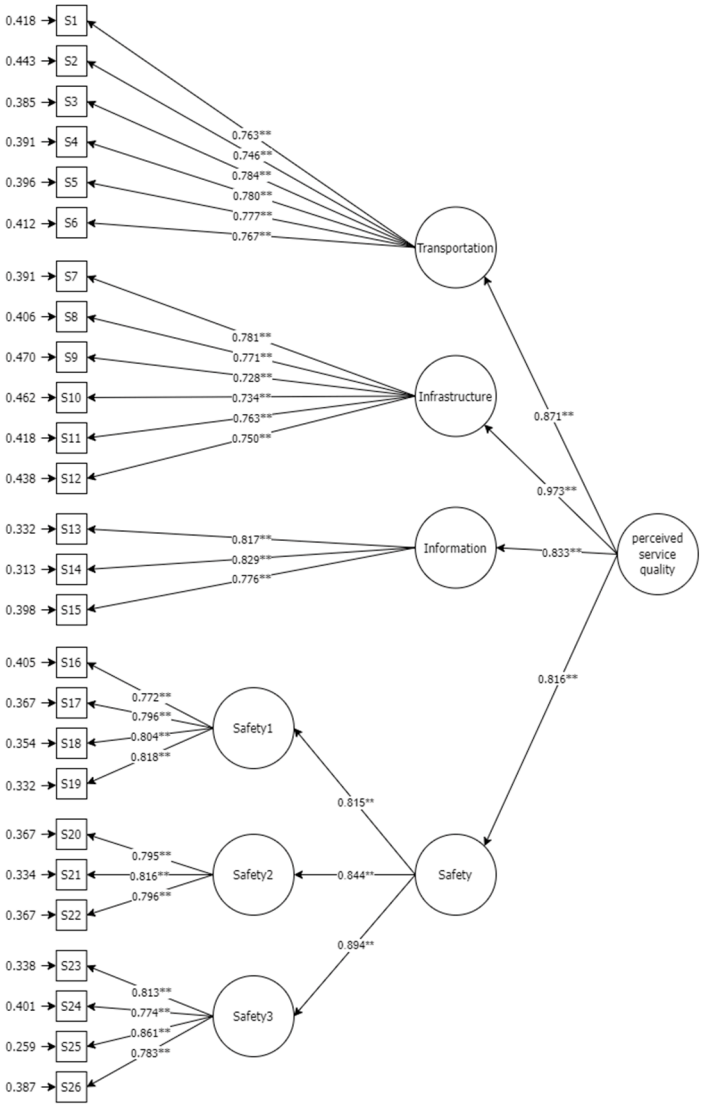

Figure 1. Results of the third-order CFA on the perceptions of parents regarding the quality of the public transport services that children use to commute to school. ** Significant at 0.01 level.

Table 11. Model fit indices of the third-order CFA.

Model	χ^2	*df*	*p*	χ^2/*df*	AIC	CFI	TLI	RMSEA	SRMR	CR
Third-Order CFA	758.098	276	<0.001	2.747	48285.639	0.962	0.955	0.048	0.038	0.977

5. Discussion and Conclusions

This study attempted to confirm the potential indicators affecting the perceptions of the quality of the public transport services by surveying 750 parents whose children use public transport to commute to schools. The EFA results reduced the number of metrics that represented the structure of the data and explained the complex interactions between variables. The study conducted component extraction using PCA, where each component was assigned at least three indicators (eigenvalue > 1), to determine the factors in the parental perception of the public transport service quality of 26 variables. There were six components for the perceptions of parents regarding the quality of the public transport services used by their children to commute to school. The model explained 67.652% of sample variance (i.e., satisfaction with transportation, infrastructure, the safe behavior of drivers, the safety policy, information, and the safety of the transportation systems). The three components of safety (the safe behavior of drivers; the safety policy; and the safety of the transportation systems) can be described as the good safety management of the public transport to school, which was placed in the same order as three other factors, namely, transportation, satisfaction, and infrastructure. The confirmatory factor analysis results revealed that the model was consistent with the empirical data, which reported that the perceptions of parents regarding the quality of the public transport services used by children to commute to school consisted of four components, namely, transport satisfaction, infrastructure, information, and safety, where the safety component was composed of three subcomponents, namely, the safe behavior of drivers, the safety policy, and the safety of the transportation systems. This result was consistent with those of previous study that used the following factors:

5.1. Transportation

The results from the CFA confirmed that the transportation factor affected perceptions of the use of public transport for commuting to schools, including:

- The availability of services or facilities to use public transport for commuting to school, consistent with the findings of de Oña, Estévez and de Oña [20], Atombo and Dzigbordi Wemegah [69], Yao, Xu, Zhang and Li [70].
- There should be a public transportation system that students can use to travel to or near the school grounds, which was in line with the studies of de Oña, Estévez and de Oña [20], Atombo and Dzigbordi Wemegah [69], Yao, Xu, Zhang and Li [70].
- There should be more than one type of public transport service in the area, allowing students to choose to use them as appropriate, which was in line with the studies of de Oña, Estévez and de Oña [20], Atombo and Dzigbordi Wemegah [69], Yao, Xu, Zhang and Li [70], Salam, Muley and Kharbeche [71].
- The use of public transportation to travel to school for students should be convenient and have no obstacles to using the service, such as easy access for getting on and off the bus, a sufficient amount of seating, and a fast travel time, which was in line with the studies of de Oña, Estévez and de Oña [20], Yao, Xu, Zhang and Li [70], d'Ovidio, Leogrande, Mancarella, Schinzano and Viola [72].
- The service time should be regularly managed, enabling students to plan their trips, which was in line with the studies of Yao, Xu, Zhang and Li [70], Agyeman and Cheng [73], Ahmed, Parvez, Hasan, Nur, Moon, Karim, Azam, Shanmugam and Jonkman [74], Sakellariou, Kotoula, Morfoulaki and Mintsis [75].
- The public transport should be connected to other modes of transport, so that students can adjust their travel plans accordingly. This was consistent with the findings of de Oña, Estévez and de Oña [20], Yao, Xu, Zhang and Li [70], Deepa, Mondal, Raman, Pinjari, Bhat, Srinivasan, Pendyala and Ramadurai [76].

5.2. Infrastructure

According to the CFA results, the infrastructure factor affected the perceptions of using public transport for commuting to school, including:

- Public transport must be easily accessible, having a drop-off point close to the origin and destination, or students must have access to public transport on their own, consistent with the findings of de Oña, Estévez and de Oña [20], Yao, Xu, Zhang and Li [70].
- There should be clearly visible signs of the public transport system for users, to indicate the pick-up point location and reduce unnecessary stops along the way, which was in line with the studies of Ren, Jin and Wu [77], Taplin and Sun [78].
- Public transport systems must have clear service routes, enabling students and parents to use them in planning their trips, and providing information to other users of the service, in line with the studies of Ren, Jin and Wu [77], Taplin and Sun [78].
- Public transport should have a clear schedule, allowing students to plan their trips and reduce waiting times for public transport. This was consistent with the findings of d'Ovidio, Leogrande, Mancarella, Schinzano and Viola [72], Ren, Jin and Wu [77], Taplin and Sun [78].
- The bus station must be clean and well-equipped (with an adequate roof, lighting, and seating) to ensure the trust and safety of the users. (which was consistent with Prasad and Maitra [17], de Oña, Estévez and de Oña [20], Sakellariou, Kotoula, Morfoulaki and Mintsis [75], Ikeda, Mavoa, Cavadino, Carroll, Hinckson, Witten and Smith [79], Mindell, Ergler, Hopkins and Mandic [80]).
- The school area should have sufficient bus terminals to accommodate the needs of students; inadequate public transport services will cause congestion and delays in travel (this was in line with the findings of Atombo and Dzigbordi Wemegah [69], Bhatnagar, Gupta, Joshi and Bolia [81]).

5.3. Information

The results of the analysis showed that the information factor influenced perceptions of the use of public transport, which included:

- There should be an information center providing accurate and clear answers to questions about public transportation to school (which was consistent with the studies of de Oña, Estévez and de Oña [20], Yao, Xu, Zhang and Li [70], Sukhov, Lättman, Olsson, Friman and Fujii [82]).
- There should be an information service for traveling to school by public transport. In addition, the service point should be clear and easy to understand for the public, which corresponded to the studies of de Oña, Estévez and de Oña [20], Atombo and Dzigbordi Wemegah [69], Yao, Xu, Zhang and Li [70], d'Ovidio, Leogrande, Mancarella, Schinzano and Viola [72], Sukhov, Lättman, Olsson, Friman and Fujii [82].
- There should be a transportation guidance application that presents accurate and up-to-date information that can meet travel planning needs in accordance with the studies of d'Ovidio, Leogrande, Mancarella, Schinzano and Viola [72], Sukhov, Lättman, Olsson, Friman and Fujii [82].

5.4. Safety

Due to the large number of safety variables, the study was analyzed using third-order confirmatory factor analysis for the strength of the model. The analyses were divided into three main subfactors, and the CFA analysis discovered that: (1) Driver safety behavior influences the perceptions of using public transportation for commuting to school. The important factors included drivers using the appropriate speed, according to the law, and safely, which was consistent with the studies of Mokarami, Alizadeh, Rahimi Pordanjani and Varmazyar [14], Karimi, Aghabayk and Moridpour [83], Davey, Wishart, Freeman and Watson [84], Ammar, Jalmoud, Boushehri and Fakhro [85]. It also included drivers not engaging in risky behaviors such as sudden lane changes (which corresponded to the studies of Karimi, Aghabayk and Moridpour [83], Varmazyar, Mortazavi, Hajizadeh and Arghami [89], Hendrix and Kennedy [90]). Further, drivers should not use phones or other communication devices while driving (which was consistent with Ammar, Jal-

moud, Boushehri and Fakhro [85], Valero-Mora, Zacares, Sánchez-García, Tormo-Lancero and Faus [86], Chee, Irwin, Bennett and Carrigan [87]). Finally, drivers must not behave inappropriately as employees, such as smoking or using intoxicants while driving, consistent with the Ratanavaraha, Jomnonkwao, Khampirat, Watthanaklang and Iamtrakul [18], Ratanavaraha and Jomnonkwao [19], Chang and Yeh [88] studies. (2) The safety of the transportation systems influenced the perceptions, consisting of public transport using the left lane for pick-up and drop-off, to increase the safety of passengers. (Thailand uses the left lane to drive), which was consistent with the studies of Mokarami, Alizadeh, Rahimi Pordanjani and Varmazyar [14], Huang, Lin and Wang [91]. Agreeing with the Mokarami, Alizadeh, Rahimi Pordanjani and Varmazyar [14], Huang, Lin and Wang [91] findings, public buses must stop in a safe spot when picking up or dropping off passengers. The driver must park on the left side and not drive off the road unless there is an emergency, as this will cause concern to passengers. (consistent with the results of Ammar, Jalmoud, Boushehri and Fakhro [85], Hendrix and Kennedy [90]). (3) The safety policy also influenced the perceptions; these factors include staff being required to check student orders before departure to check passenger safety (as in Salam, Muley and Kharbeche [71], d'Ovidio, Leogrande, Mancarella, Schinzano and Viola [72], Agyeman and Cheng [73], Hendrix and Kennedy [90]). Public transport vehicles must be equipped with emergency accident prevention equipment such as fire extinguishers (for large vehicles) and guardrails to prevent falling children (in small vehicles), which was consistent with the studies of Ratanavaraha, Jomnonkwao, Khampirat, Watthanaklang and Iamtrakul [18], Jomnonkwao and Ratanavaraha [92], Davis and Abulhassan [93], Olympia, Weber, Brady and Ho [94]. There should be a support or anti-theft device, which corresponded to the study of de Oña, Estévez and de Oña [20], Atombo and Dzigbordi Wemegah [69], Yao, Xu, Zhang and Li [70], d'Ovidio, Leogrande, Mancarella, Schinzano and Viola [72], and public transportation must be safe from road accidents, which was consistent with the findings of de Oña, Estévez and de Oña [20], Atombo and Dzigbordi Wemegah [69], Sukhov, Lättman, Olsson, Friman and Fujii [82], Deb, Ali Ahmed and Das [95].

6. Limitations and Suggestions for Future Studies

Although this study fulfilled the objectives for a study on the parental perceptions of the quality of children's public transport services on school trips, this study did not enter the heterogeneity of the sample into the analysis. Therefore, future studies considering heterogeneity may be able to better describe the results of the analysis. In addition, analyzing models with SEM can lead to more accurate and complex robust structures.

Author Contributions: Conceptualization, S.J. and C.B.; Data curation, S.N. and T.J.; Formal analysis, S.J. and C.B.; Funding acquisition, S.J.; Methodology, S.N., T.J., and T.C.; Project administration, P.J.; Supervision, V.R. and P.J.; Validation, V.R. and P.J.; Writing—original draft, S.N. and T.J.; Writing—review and editing, S.J., C.B., and T.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by (i) Suranaree University of Technology (SUT), (ii) Thailand Science Research and Innovation (TSRI), and (iii) the National Science Research and Innovation Fund (NSRF) (Grant number: FF7-704-65-24-68(16)), and the APC was funded by the Suranaree University of Technology (Grant number: RU-7-706-59-03).

Institutional Review Board Statement: The study was approved by the Human Research Ethics Committee of Suranaree University of Technology (COE No.126/2564).

Informed Consent Statement: Not applicable.

Data Availability Statement: Data are available on request from the authors.

Acknowledgments: The authors would like to thank the Suranaree University of Technology Research.

Conflicts of Interest: The authors declare no conflict of interest.

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