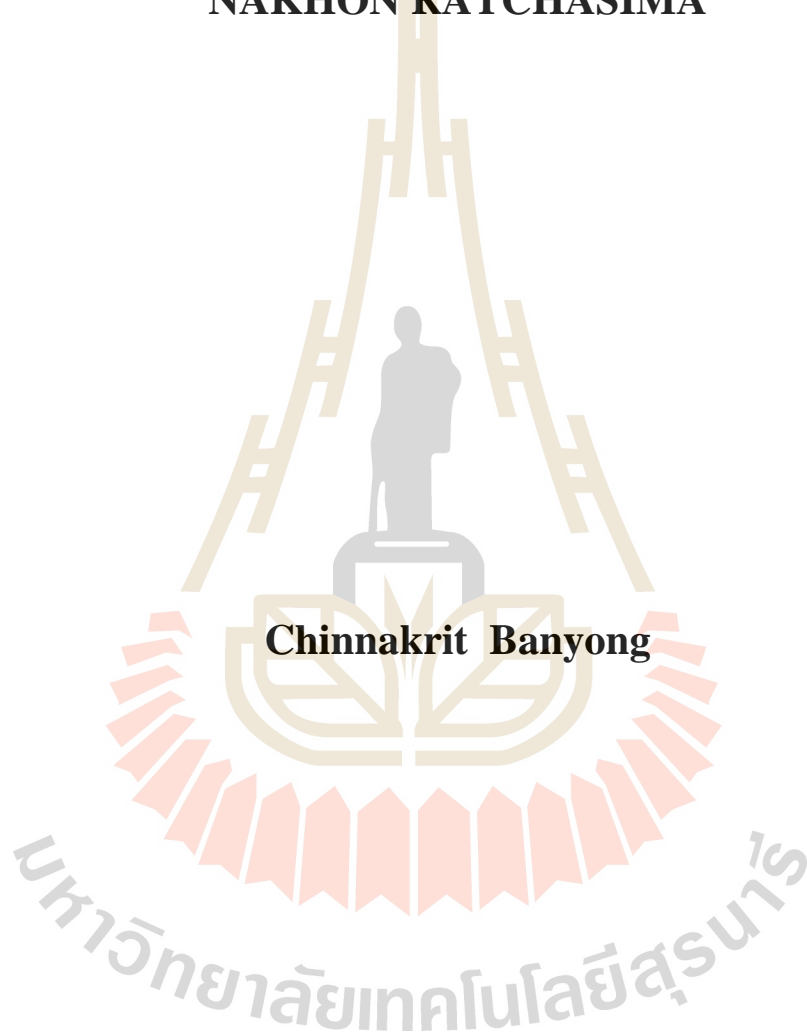


**FACTORS INFLUENCING MODE OF TRAVEL TO  
SCHOOL: A CASE STUDY OF  
NAKHON RATCHASIMA**



**Chinnakrit Banyong**

**Thesis Submitted in Partial Fulfillment of the Requirements for the  
Degree of Master of Engineering in Civil, Transportation  
and Geo-resources Engineering  
Suranaree University of Technology  
Academic Year 2019**

ปัจจัยที่มีอิทธิพลต่อรูปแบบการเดินทางไปโรงเรียน: กรณีศึกษาในเขต  
จังหวัดนครราชสีมา



นายชินกฤต บรรยงค์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต  
สาขาวิชาวิศวกรรมโยธา ขนส่ง และทรัพยากรธรณี  
มหาวิทยาลัยเทคโนโลยีสุรนารี  
ปีการศึกษา 2562

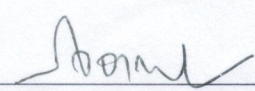
**FACTORS INFLUENCING MODE OF TRAVEL TO SCHOOL: A  
CASE STUDY OF NAKHON RATCHASIMA**

Suranaree University of Technology has approved this thesis submitted in partial fulfillment of the requirements for a Master's Degree.


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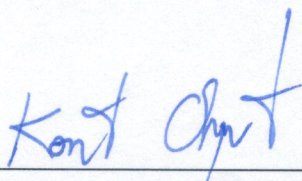
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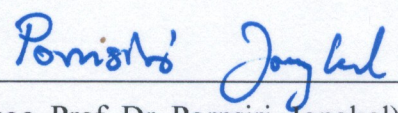
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จังหวัดนครราชสีมา (FACTORS INFLUENCING MODE OF TRAVEL TO  
SCHOOL: A CASE STUDY OF NAKHON RATCHASIMA) อาจารย์ที่ปรึกษา :  
ผู้ช่วยศาสตราจารย์ ดร.สังจากาจ จอมโนนเขวา, 71 หน้า.

ประเทศไทยได้รับการจัดอันดับเป็นประเทศที่แออัดระดับโลกและจังหวัดนครราชสีมา  
เป็นพื้นที่หนึ่งในประเทศไทยที่ประสบปัญหาดังกล่าวเนื่องจากเป็นศูนย์กลางความเจริญโดยเฉพาะ  
อย่างยิ่งพื้นที่บริเวณโรงเรียนที่มีนักเรียนจำนวนมากเดินทางด้วยยานพาหนะส่วนบุคคลก่อให้เกิด  
ปัญหาการจราจรติดขัด ดังนั้นการจัดการระบบขนส่งสาธารณะจึงถูกนำมาใช้เพื่อแก้ปัญหา  
โดยสาธารณะเป็นรูปแบบการขนส่งสาธารณะที่นักเรียนใช้บริการซึ่งการพัฒนา นโยบายเพื่อให้  
นักเรียนใช้รถโดยสารสาธารณะได้อย่างมีประสิทธิภาพจำเป็นต้องเข้าใจการตัดสินใจเกี่ยวกับปัจจัย  
ในการเลือกรูปแบบการเดินทางของนักเรียน โดยการศึกษาก่อนหน้านี้พบว่า การตัดสินใจในการ  
เลือกรูปแบบการเดินทางของนักเรียนถูกตัดสินใจโดยผู้ปกครองและได้มุ่งเน้นเฉพาะปัจจัยทางด้าน  
สิ่งแวดล้อมเท่านั้น ในขณะที่การศึกษาปัจจัยทางจิตวิทยาสามารถนำไปสู่การอธิบายพฤติกรรม  
เลือกรูปแบบการเดินทางที่ดียิ่งขึ้น จึงได้ทำการศึกษปัจจัยทางจิตวิทยาเพื่อเลือกรูปแบบการ  
เดินทางไปโรงเรียนเป็น 3 การศึกษาโดยเก็บข้อมูลจากกลุ่มผู้ปกครองที่มีบุตรศึกษาอยู่ในพื้นที่เขต  
เมืองนครราชสีมา

การศึกษาที่ 1 การสร้างแบบจำลองสมการ โครงสร้างเพื่อวิเคราะห์ปัจจัยที่มีอิทธิพลต่อการ  
เลือกรูปแบบการเดินทางไปโรงเรียนและพัฒนาแบบจำลองสมการ โครงสร้างภายใต้กรอบแนวคิด  
ทฤษฎีพฤติกรรมตามแบบแผนในการเลือกรูปแบบการเดินทางไปโรงเรียน เก็บข้อมูลด้วย  
แบบสอบถามจากกลุ่มผู้ปกครองที่มีบุตรศึกษาอยู่ในพื้นที่เขตเมืองนครราชสีมาจำนวน 680  
ตัวอย่างวิเคราะห์ด้วยแบบจำลองสมการ โครงสร้าง พบว่า เมื่อพิจารณาระหว่างกลุ่มผู้ใช้  
รถจักรยานยนต์และผู้ใช้รถโดยสารสาธารณะปัจจัยด้านความตั้งใจในการใช้รถโดยสารสาธารณะ  
ส่งอิทธิพลมากที่สุดต่อการเลือกรูปแบบการเดินทางไปโรงเรียน โดยได้รับอิทธิพลจากทัศนคติ การ  
คล้อยตามกลุ่มอ้างอิง การรับรู้ถึงการควบคุมพฤติกรรมและเมื่อพิจารณากลุ่มผู้ใช้รถยนต์ส่วนบุคคล  
และผู้ใช้รถโดยสารสาธารณะปัจจัยด้านความตั้งใจในการใช้รถโดยสารสาธารณะส่งอิทธิพลมาก  
ที่สุดต่อการเลือกรูปแบบการเดินทางไปโรงเรียน โดยได้รับอิทธิพลจากทัศนคติ การคล้อยตามกลุ่ม  
อ้างอิง การรับรู้ถึงการควบคุมพฤติกรรม ซึ่งผลจากการศึกษานี้สามารถนำไปออกแบบนโยบายใน  
การสนับสนุนให้นักเรียนลดการเดินทางด้วยยานพาหนะส่วนบุคคลมาใช้รถโดยสารสาธารณะใน  
การเดินทางไปโรงเรียน

การศึกษาที่ 2 การศึกษาเพื่อหาปัจจัยในการเลือกรถโดยสารสาธารณะในการเดินทางไปโรงเรียน เก็บข้อมูลด้วยแบบสอบถาม 680 ตัวอย่างวิเคราะห์ข้อมูลด้วยการถดถอยโลจิสติกภายใต้กรอบแนวคิดทฤษฎีพฤติกรรมตามแบบแผน พบว่าปัจจัยที่มีอิทธิพลต่อการใช้รถโดยสารสาธารณะได้แก่ ความตั้งใจที่จะใช้รถโดยสารสาธารณะ การคล้อยตามกลุ่มอ้างอิงในการใช้รถโดยสารสาธารณะ และทัศนคติต่อการใช้บริการรถโดยสารสาธารณะ ซึ่งปัจจัยเหล่านี้สามารถใช้เพื่อกำหนดนโยบาย การขนส่งที่ส่งเสริมให้นักเรียนใช้รถโดยสารสาธารณะและลดปัญหาการจราจรติดขัดบริเวณ โรงเรียน

การศึกษาที่ 3 การสร้างแบบจำลองเพื่อวิเคราะห์ปัจจัยที่มีอิทธิพลต่อการเลือกรถโดยสารสาธารณะในการเดินทางไปโรงเรียนและพัฒนาแบบจำลองสมการโครงสร้างภายใต้กรอบแนวคิด ทฤษฎีแบบแผนความเชื่อด้านสุขภาพในการเลือกรถโดยสารสาธารณะในการเดินทางไปโรงเรียน เก็บข้อมูลด้วยแบบสอบถามจำนวน 633 ตัวอย่างวิเคราะห์ข้อมูลด้วยแบบจำลองสมการโครงสร้าง พบว่าสิ่งชักนำสู่การปฏิบัติส่งอิทธิพลต่อการเลือกใช้รถโดยสารสาธารณะมากที่สุด รองลงมาการ รับรู้อุปสรรคส่งอิทธิพลต่อการไม่เลือกใช้รถโดยสารสาธารณะและแรงจูงใจด้านสุขภาพส่ง อิทธิพลต่อการเลือกใช้รถโดยสารสาธารณะซึ่งผลการวิจัยสามารถใช้เป็นแนวทางในการวางแผน ส่งเสริมให้นักเรียนให้ใช้รถส่งสาธารณะในการเดินทางไปโรงเรียนเพิ่มขึ้น

มหาวิทยาลัยเทคโนโลยีสุรนารี

CHINNAKRIT BANYONG : FACTORS INFLUENCING MODE OF  
TRAVEL TO SCHOOL: A CASE STUDY OF NAKHON RATCHASIMA.  
THESIS ADVISOR : ASST. PROF. SAJJAKAJ JOMNONKWA, Ph.D.,  
71 PP.

#### FACTORS/MODE OF TRAVEL/SCHOOL

Thailand is ranked as an overcrowded country in the world and Nakhon Ratchasima is an area in Thailand that experiences the problem, especially in the school area where many students use personal vehicles to go. This causes traffic congestion. Therefore, public transportation management has been used to solve problems. As a public bus is a mode of transportation students use, the developed policy to efficiently promote students to use public buses indispensably requires the understanding of the factors for their travel mode choice. The previous studies have found that the student's travel mode choice is decided by parents and focused on only environmental factors, while the study of psychological factors potentially lead to better explanation on the behavior of school-travel mode. Therefore, this research has conducted 3 studies to investigate psychological factors for school-travel mode choice. The sampled group in this study consisted of parents whose children are studying at the secondary school level in Mueang Nakhon Ratchasima District.

Study 1: Structural Equation Modeling was established to analyze the factors Influencing the School- Travel Mode choice and develop Structural Equation Model under the Theory of Planned behavior. The data were collected from 680 parents and analyzed by using Structural Equation Modeling. it was found that when considering between motorcycle users and public bus users, the factor of Intention to use public



## ACKNOWLEDGEMENTS

The author would like to pay great respects to persons, groups of people who give good advice and help me both in academic and research work as mentioned illustrations:

First and foremost, I would like to thank my thesis advisor, Asst. Prof. Dr. Sajjakaj Jomnonkwa for his suggestions in every step and comments throughout my research procedure.

Professor Dr. Vatanavongs Ratanavaraha, who for suggestions and all their help. Ms. Wanpen Suebsai, Secretary of Transportation Engineering, who helps coordinate various documentaries during the study. Suranaree University of Technology which supports the scholarship.

Finally, I am most grateful to my parents, who well support education and my friends both in both masters and doctoral degree courses for all their support throughout the period of this research

Chinnakrit Banyong



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## SYMBOLS AND ABBREVIATIONS

	=	Statistically significant level
	=	Structural coefficient
M	=	Mean
SD	=	Standard deviation
SK	=	Skewness
KU	=	Kurtosis
LR	=	Logistic regression
$\chi^2$	=	Chi-square
df	=	Degree of freedom
RMSEA	=	Root mean square of approximation
SRMR	=	Standardized root mean residual
CFI	=	Comparative fit index
TLI	=	Tucker Lewis Index
SEM	=	Structural equation modeling
CFA	=	Confirmatory factor analysis
TPB	=	Theory of planned behavior
HBM	=	Health Belief Model



# CHAPTER I

## INTRODUCTION

### 1.1 Rationale for the research

Thailand is ranked as one of the world's most congested countries. Referring to INRIX (2018) Thai people spend an average of 56 hours per year on traffic congestion in 2017, which is a problem caused by the increasing traffic volume. According to the statistics from the Department of Land Transport, under Motor Vehicle Act 2019 and Land Transport Act, Thailand has a total of 39,160,454 new registered vehicles including 38,171,210 private cars and motorcycles. When compared to the vehicle numbers in 2015, there were new cars registered under Motor Vehicle Act 2019 and Land Transport Act totaling 35,546,514 cars including 34,616,257 private cars and motorcycles (Department of Land Transport, 2019a).

Nakhon Ratchasima is an area in Thailand where the use of private cars and motorcycles has increased. When considering the statistics from the Department of Land Transport, the number of new 1,336,960 vehicles registered under Motor Vehicle Act 2019, when compared to that of 2015. This causes traffic congestion during rush hours, particularly in urban areas which are centers of prosperity, economic activities, education, trade, and services. Areas around schools are especially crowded; most students travel to school (La Vigne, 2007) in private cars (54%), followed by public transportation (17%), school buses (15%), and motorcycles (14%) (Napat, 2013). The large use of private vehicles such as private cars and

motorcycles in the school area increases the risk of road accidents (Albertsson & Falkmer, 2005) and mental health problems, energy problems, and air and noise pollution. Besides traffic jams and air pollution effects, the problem with using personal vehicles around school areas is the risk of road accidents involving students (Morris, Wang, & Lilja, 2001). Thus, public transport management could solve this problem and create sustainable transportation creation (Intikhab Ahmed Qureshi & Huapu Lu, 2007). The public bus is one mode of public transportation systems accessible to students. Student's choice of travel mode should be understood to develop student bus use policies efficiently. A study of McMillan (2005) found that parents influences students' choice of travel mode.

The previous study was only focus on physical factors while the study of psychological factors also affect to the decision (M. Ben-Akiva & Boccara, 1987) and lead to more realistic explanation of the selection behavior (Moshe Ben-Akiva et al., 2002).

### **1.1.1 Theory of planned behavior on travel mode**

The Theory of Planned Behavior which is a social psychology theory presented by Ajzen (1991), developed this theory from Theory of reasoned action and Planned Behavior. To explain, human behavior is greatly influenced by Behavioral intention consisting of 3 factors including Attitude, Subjective norm, and perceived behavioral control. There have been previous studies, which applied the Theory of Planned Behavior, including the study of Planned Behavior in plane travel mode (Morten, Gatersleben, & Jessop, 2018), the study of Planned Behavior in using public transport system (Kamarudin, Kanesh, Basil, Joewono, & Ahmad, 2016), and the

study of Planned in travel mode change from a private vehicle to a public bus (Chen & Lai, 2011; Eriksson & Forward, 2011).

### **1.1.2 Health belief model on travel mode**

The Health Belief Model Theory has been developed based on Lewin (1951)'s Field Theory, which believes that learning occurs when a person has the motivation or drive to move themselves to their desired destination. It can be explained that a person will follow the recommendations for preventing or recovering from the disease when the practice is more positive than difficult (Maiman & Becker, 1974). Later, Rosenstock (1974) concluded that the theory of Health Belief Model consists of Perceived Severity of Disease, Perceived Benefits of Preventive Action, and Perceived Barriers to Preventive Action. After that, Maiman and Becker (1974) added Modifying factors and Cues to Action. The Health Belief model theory has been widely used to predict an individual's health behaviors and the health behaviors were subsequently adjusted when receiving the advice. Moreover, there have been the study results of meta-analysis on Theory of Social Behavior such as Carpenter (2010), Noar, Benac, and Harris (2007) which found that HBM can soundly predict behavior.

## **1.2 Purpose of the research**

1.2.1 To investigate and analyze the factors influencing the students' mode of travel to school.

1.2.2 To develop the structural equation modeling of students' mode choice for school trip.

1.2.3 To find factors influencing parents' decision to choose the school bus for their students.

1.2.4 To investigate and analyze the factors influencing the students' mode of travel to school by public buses and develop the structural equation modeling of students' public bus mode choice for school trip.

### **1.3 Scope of the research**

1.3.1 Population and samples: a group of parents whose children are studying in the secondary level.

1.3.2 Area of study: Schools within the Muang District Nakhon Ratchasima Province.

1.3.3 Modes of traveling to be considered are personal cars, motorcycles, and public.

### **1.4 Research questions**

1.4.1 Which factors influence the parents' decision on choosing the students' travel mode to school in the Mueang District, Nakhon Ratchasima Province under the framework of the Theory of Planned Behavior?

1.4.2 Can the study help comprehend the parents' decision on students' school-travel mode choice in Mueang District Nakhon Ratchasima by using structural equation modeling under the conceptual framework of the Theory of Planned Behavior?

1.4.3 Which factors influence the parents' decision to choose the public buses to schools in Mueang District, Nakhon Ratchasima Province, under the conceptual framework of the Theory of Planned Behavior?

1.4.4 Can the study help comprehend the parents' decision on students' school-travel mode choice in Mueang District Nakhon Health Belief Model?

## **1.5 Contribution of the research**

1.5.1 From the study results, the factors, which influenced the students' school-travel mode choice by parents' decisions based on the application of the Theory of Planned Behavior at a significant level, can be taken to help develop public transportation policies in Nakhon Ratchasima.

1.5.2 The results of this study can be used to support students to go to school by public transport to raise awareness on the public bus use and public use promotion.

1.5.3 The study results can lead to factors which influenced the students' school-travel mode choice by parents' decisions based on the application of the Theory of Health Belief Model (HBM) at a significant level, can be taken to help develop public transportation policies in Nakhon Ratchasima.

## **1.6 Organization of the research**

This research has studied the factors influencing mode of travel to school: a case study of NAKHON RATCHASIMA. The components totally comprise 5 chapters including the following details.

Chapter I: Introduction, this part mentions the background, the importance of each research section, research objectives, scope of research, research questions, and contribution to this research.

Chapter II: The analyze the factors influencing the school- travel mode choice and develop structural equation model under the theory of planned behavior.

Chapter III: Find the factors for choosing public buses to travel to school and analyzed by logistic regression under the conceptual framework of the theory of planned behavior.

Chapter IV: The establishment of a model to analyze factors influencing school-travel mode choice by public buses and develop structural equation modeling under the conceptual framework of health belief model in school-travel mode choice by public bus.

Chapter V: A summary of the analysis of all 3 studies (sections 2 - 4).

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# CHAPTER I I

## FACTORS INFLUENCING MODE OF TRAVEL TO SCHOOL: A CASE STUDY OF NAKHON RATCHASIMA

### 2.1 Abstract

Thailand is ranked as the world's most congested country and Nakhon Ratchasima is one area in Thailand encountering that problem, especially the school area to which a large number of students travel by private vehicles. Therefore, this study aims to investigate and analyze the factors influencing the students' mode of travel to school by public buses and develop the structural equation modeling of students' public bus mode choice for school trip. The sample group consisted of 680 parents whose children are studying at the secondary school level in Mueang Nakhon Ratchasima District. The data were collected by using a questionnaire and were analyzed by structural equation modeling according to theory of planned behavior. From the model of factors influencing motorcycle mode choice for school trip (between public buses and motorcycles), it was found that the behavioral intention to choose public buses to school has the most effect ( $\beta = -0.944$ ), which is influenced by the attitudes, subjective norm, and perceived behavioral control in using public buses. In addition, the model of factors influencing private car mode choice to school (between public buses and private cars) showed that behavioral intention to choose public buses for school trip has the most effect ( $\beta = -0.675$ ), which is influenced by the attitudes, subjective norm, and perceived behavioral control in using public buses.

The results of this research can be the guidelines for planning to promote students to public transport use for school trip.

## **2.2 Introduction**

Thailand is ranked as one of the world's most congested countries. Referring to INRIX (2018), Thai people spend an average of 56 hours per year on traffic congestion in 2017, which is a problem caused by the increasing traffic volume. According to the statistics from the Department of Land Transport, under Motor Vehicle Act 2019 and Land Transport Act, Thailand has a total of 39,160,454 new registered vehicles including 38,171,210 private cars and motorcycles. When compared to the vehicle numbers in 2015, there were new cars registered under Motor Vehicle Act 2019 and Land Transport Act totaling 35,546,514 cars including 34,616,257 private cars and motorcycles which increased by 9.23%, while under Motor Vehicle Act, the number of new private cars and motorcycles registered was 9.31% (Department of Land Transport, 2019a).

Nakhon Ratchasima is an area in Thailand where the use of private cars and motorcycles has increased. When considering the statistics from the Department of Land Transport, the number of new 1,336,960 vehicles registered under Motor Vehicle Act 2019 and Land Transport Act has increased by 8.36% when compared to that of 2015. This causes traffic congestion during rush hours, particularly in urban areas which are centers of prosperity, economic activities, education, trade, and services. School is one of the places with various activities; a lot of students travel to school for their education. For mode choice of travel to school, the students in

Nakhon Ratchasima have chosen to travel with private cars (54%), motorcycles (14%), school buses (15%), and public buses (17%) (Napat, 2013).

The large use of private vehicles such as private cars and motorcycles in the school area increases the risk of road accidents (Albertsson & Falkmer, 2005) and mental health problems, energy problems, and air and noise pollution. Therefore, public transportation management has been settled to solve problems and create a sustainable transportation system (I. A. Qureshi & H. Lu, 2007). The public bus is a form of public transportation that students to use its service. The policy development for students to use public buses effectively needs to understand the decisions about the students' travel mode choice. Previous studies have focused on the psychological factors to choose the mode of transport depending on individual decision. From the study of McMillan (2005), it was found that parents' decisions have a direct influence on the students' travel mode choice.

Therefore, this study investigated the factors influencing the students' travel mode choice and the factors that affect the parents' decisions. Also, this study aims (1) to analyze the factors influencing the school travel mode of public buses and (2) to develop the structural equation model of students' travel mode choice of public buses.

In the publications, many numerous researches on theory planned behavior toward on travel mode. Some examples of the researches which have focused on theory planned behavior toward travel mode are shown in Table 2.1

**Table 2.1** Summary of the relevant studies on the theory of planned behavior

Author(s) (year)	Mode of transport	Analysis method	Factors				
			Intention	Attitudes	Subjective norm	Perceived behavioral	
Morten et al. (2018)	Airplane	Hierarchical multiple regression analysis		✓	✓	✓	
Liu , Sheng, Mundorf, Redding, and Ye (2017)	Private car	SEM		✓	✓		✓
Kamarudin et al. (2016)	Public transport	Multiple regression analysis		✓			✓
Lo, van Breukelen, Peters, and Kok (2016)	Private car, public transport, bicycle	SEM	✓	✓			✓
Donald, Cooper, and Conchie (2014)	Public transport, private car	SEM	✓	✓	✓		✓

**Table 2.1** Summary of the relevant studies on the theory of planned behavior

(Continued)

Author(s) (year)	Mode of transport	Analysis method	Factors			
			Intention	Attitudes	Subjective norm	Perceived behavioral control
Nordfjaern, Simsekoglu, and Rundmo (2014)	Public transport, private car	SEM		✓	✓	
Chen and Chao (2011)	Public transport, private car, motorcycle	SEM		✓	✓	
Chen and Lai (2011)	Public transport, private car, motorcycle	Regression analysis	✓	✓	✓	✓
Eriksson and Forward (2011)	Private car, bus, bicycle	Hierarchical regression analyses	✓		✓	✓
Long, Choocharukul, and Nakatsuji (2011)	Sky train	SEM		✓	✓	✓

## **2.3 Materials and Methods**

### **2.3.1 Theory of Planned Behavior (TPB)**

Theory of planned behavior (TPB) is the study on the attitudes and the influence of attitudes on behavior change. The principles of planned behavior state that human behavior is greatly influenced by behavioral intention. The three factors (Ajzen, 1991) influencing behavior are attitudes, subjective norm, and perceived behavioral control.

### **2.3.2 Structural Equation Modeling (SEM)**

Structural equation modeling is the model used to estimate the test of the relationship between various variables. This model is the result of synthesis of three important data analysis methods, namely, factor analysis, path analysis, and parameter estimation in regression analysis; the structural equation model accepts the measurement variances correlated (Hair, 2010) to the structural equation model which consists of two sub models: the measurement model and structural model.

### **2.3.3 Data Collection**

This study collected data using self-administered questionnaires. The samples were drawn from parents of secondary school students studying in 21 schools in Mueang Nakhon Ratchasima District (The Office of Academic Promotion and Registration, 2019) using stratified random sampling classified by school type. According to the study of T. Golob (2003), the suggested number of samples in the structural equation modeling used for estimating the maximum likelihood is at least 15 times than that of observable variables. In the study, the numbers of observable variables is 21. In total, there are 315 samples. However, for reserve samples, 680

samples were collected to prevent sample errors or damage, which were considerably sufficient for SEM analysis were collected.

#### 2.3.4 Questionnaire

The researcher used the Likert scale to collect the data. It is divided into five levels: most agreeable, agreeable, not sure, disagreeable, and strongly disagreeable (5 as the highest score and 1 as the lowest score). The components of the questionnaire are divided into three parts: part 1, the socioeconomic status of parent; part 2, how to choose the transportation mode to school; and part 3, the planned behavior data toward the use of public buses. In addition, in the research, the researcher used the structural equation analysis. The variables can be summarized, as shown in Table 2.

**Table 2.2** Variable names and definitions of variables, factors affecting school travel

Variable name	Definition of variable	Description
MODE	The school travel mode which parents decide for their children	For model public bus and motorcycle 0= Choose public bus 1= choose motorcycle
		For model public bus and private car 0= choose public bus 1= choose private car

**Table 2.2** Variable names and definitions of variables, factors affecting school travel mode choice (Continued)

Variable name	Definition of variable	Description
DIST_1	The distance between home and the public bus boarding point	1= less than 0.5 km 2=0.5–1 km 3=1.1–1.5 km 4=1.6–2 km 5=2.1–2.5 km 6= more than 2.5 km
WAIT	The duration of waiting time for public buses	1= less than 10 minutes 2=10–20 minutes 3=21–30 minutes 4= more than 30 minutes
POINT	Number of trips transferring public buses to school	1= 1 hop 2= 2 hops 3= more than 2 hops
COST	Expenditure for using public buses to go to and return from home and school	1= less than 10 baht 2= 10–20 baht 3= 21–30 baht 4= more than 30 baht



<b>Variable name</b>	<b>Definition of variable</b>	<b>Description</b>
DIST_2	The distance between home and school	1=less than 5 km 2=5–10 km 3=11–15 km 4=16–20 km 5=21–25 km 6=26–30 km 7=31–35 km 8=more than 35 km
TIME	The travel time to and from home and school by public buses	1=less than 10 minutes 2=10–20 minutes 3=21–30 minutes 4=31–40 minutes 5=41–50 minutes 6= more than 50 minutes
<b>Attitudes</b>	<b>Attitudes toward the use of public buses</b>	
T1	Using public buses is convenient and comfortable	1=Strongly disagree 2=Disagree 3=Undecided 4=Agree 5=Strongly agree
T2	Using public buses is safe	4=Agree 5=Strongly agree
T3	Public buses yield satisfactory service	
T4	Using public buses helps save expenditure	

<b>Variable name</b>	<b>Definition of variable</b>	<b>Description</b>
T5	Using public buses helps reduce pollution and environmental problems	
<b>Subjective Norm</b>		
<b>Subjective norm in using public buses</b>		
<b>Norm</b>		
T6	Your friend thinks that you should allow the students in your supervision to go to school by public buses	1=Strongly disagree 2=Disagree 3=Undecided 4=Agree 5=Strongly agree
T7	Your family thinks that you should have the students in your supervision go to school by public buses	
T8	Most of the people in your community have the students in their supervision go to school by public buses	
T9	Most people surrounding you have the students in their supervision go to school by public buses	
<b>Perceived behavioral control</b>		
<b>Perceived behavioral control in using public buses</b>		
T10	The students in your supervision	1=Strongly disagree

<b>Variable name</b>	<b>Definition of variable</b>	<b>Description</b>
	potentially use public bus service to go to school conveniently	2=Disagree 3=Undecided
T11	Using public buses is easy for the students in your supervision	4=Agree 5=Strongly agree
T12	The students in your supervision potentially use public bus service to do other activities beyond going to school	
<b>Intention</b>	<b>Intention to use public buses</b>	
T13	The students in your supervision have intention to use public buses to go to school on a regular basis/most frequently	1=Strongly disagree 2=Disagree 3=Undecided 4=Agree 5=Strongly agree
T14	The students in your supervision are more likely to go to school by public buses	
T15	You attempt to have the students in your supervision to go to school by public buses next time/next semester	

## 2.4 Results and Discussion

### 2.4.1 Sample Characteristics

According to the survey of 680 parents, it was found that personal information and socioeconomic status consist of male students (48%), female students (52%), aged between 13 and 15 years (59%), aged between 16 and 18 years 41%, lower secondary school students (59%), and high school students and high school graduates (41%). For parents answering the questionnaires, they consist of male (45%), female (55%), aged between 40 and 49 years (54%), and having 2–3 family members (62%). For education level, the highest education level is bachelor's degree (34%), having household income of 30000–39999 baht/month (29%), and spending most of their time on regular work (76%). For travel mode choice to work, they most possessed motorcycles (92%) and private cars (73%) and mostly have motorcycle license (87%), followed by private car license (70%). Most of travel mode to work is using private cars (55%). In addition, the most preferred travel mode choice to school is motorcycles (40%), followed by private cars (39%), and public buses (21%).

### 2.4.2 Descriptive Statistics

Table 2.3 shows descriptive statistical data of public transportation mode choice to school consisting of mean, standard deviation, skewness, and kurtosis. It was found that the data have a normal distribution because the SK value should be in the range -3.0 to +3.0 and KU values should be lower than 10.0 (Rex B. Kline, 2011).

**Table 2.3** Descriptive statistics

	<b>Public buses and motorcycle</b>				<b>Public buses and private cars</b>			
	<b>M</b>	<b>S.D.</b>	<b>SK</b>	<b>KU</b>	<b>M</b>	<b>S.D.</b>	<b>SK</b>	<b>KU</b>
DIST_1	2.20	0.94	0.70	-0.31	2.51	1.23	1.08	0.61
WAIT	2.06	0.44	0.28	2.10	1.90	0.56	0.22	1.21
POINT	1.27	0.45	1.02	-0.97	1.18	0.39	1.65	0.73
COST	2.61	0.85	0.84	-1.07	2.49	0.78	1.17	-0.35
DIST_2	3.32	1.63	1.48	1.90	2.51	1.39	1.51	3.02
TIME	2.95	1.01	0.97	0.59	2.47	1.19	1.10	1.36
T1	2.84	1.48	0.16	-1.36	3.58	1.16	-0.51	-0.53
T2	2.70	1.26	0.28	-0.76	3.29	1.12	-0.22	-0.50
T3	2.87	1.38	0.04	-1.19	3.26	1.03	-0.08	-0.29
T4	2.97	1.41	0.10	-1.21	3.75	1.23	-0.66	-0.57
T5	2.96	1.35	0.19	-1.22	3.78	1.29	-0.77	-0.55
T6	3.46	1.20	-0.69	-0.69	3.50	1.13	-0.56	-0.28
T7	3.74	1.00	-0.75	0.25	3.51	1.19	-0.37	-0.75
T8	3.49	0.86	-1.00	0.14	3.47	0.99	-0.54	-0.12
T9	3.73	1.10	-0.45	-0.51	3.58	1.15	-0.41	-0.62
T10	2.57	1.20	0.13	-1.06	3.30	1.11	-0.39	-0.48
T11	2.84	1.22	-0.03	-0.90	3.28	1.15	-0.12	-0.78
T12	2.75	1.30	0.33	-0.91	3.32	1.30	-0.24	-1.07
T13	3.04	1.18	0.06	-0.99	3.35	1.11	-0.44	-0.48

**Table 2.3** Descriptive statistics (Continued)

	Public buses and motorcycle				Public buses and private cars			
	M	S.D.	SK	KU	M	S.D.	SK	KU
T14	2.90	1.00	-0.23	-0.97	3.27	0.98	-0.58	0.01
T15	2.61	1.58	0.45	-1.36	3.37	1.27	-0.20	-0.99

### 2.4.3 Confirmatory Factor Analysis

Mplus version 7 was used to assess CFA of theory of planned behavior toward public buses. Table 2. illustrates the CFA model for the perceptions data with the following goodness-of-fit statistics:  $\chi^2/df= 1.811$ ,  $p < 0.001$ , RMSEA = 0.044, SRMR = 0.022, CFI = 0.989, and TLI = 0.981. Table 2. illustrates the CFA model for the expectations data with the following goodness-of-fit statistics:  $\chi^2/df= 2.733$ ,  $p < 0.001$ , RMSEA = 0.065, SRMR = 0.036, CFI = 0.958, and TLI = 0.939. When compared to the criteria shown in Table 2., the model contains the model fit indices are in accordance with the acceptable limits. The constructed latent variables are consistent with the question items, which are indicators, and relevant to the theory of planned behavior used as a reference frame as various variables can be used for structural equation modeling analysis.

**Table 2.4** Criterion of model fit indices

Model fit indices	Acceptable limits	References
Chi-square	$\chi^2/df$ 5	(Deb & Ahmed, 2018)
Degrees of freedom	df	
Root mean square error of approximation	RMSEA 0.08	(Deb & Ahmed, 2018; Hu, Zhao, & Wang, 2015)
Comparative fit index	CFI > 0.9	(Deb & Ahmed, 2018; Hu et al., 2015)
Tucker-Lewis index	TLI > 0.8	(Hooper, Coughlan, & Mullen, 2008)
Standardized root mean residual	SRMR 0.08	(Schreiber, Nora, Stage, Barlow, and King, 2006)

**Table 2.5** Confirmatory factor analysis of theory of planned behavior toward public buses (public buses and motorcycles)

	Indicators	Estimate <sup>a</sup>	SE	Est./S.E.	R <sup>2</sup>
<b>Intention</b>					
T13	The students in your supervision have intention to use public buses to go to school on a regular basis/most frequently	0.814	0.024	34.194	0.651

**Table 2.5** Confirmatory factor analysis of theory of planned behavior toward public buses (public buses and motorcycles) (Continued)

	<b>Indicators</b>	<b>Estimate<sup>a</sup></b>	<b>SE</b>	<b>Est. /S.E.</b>	<b>R<sup>2</sup></b>
T15	You attempt to have the students in your supervision to go to school by public buses next time/next semester	0.752	0.027	28.379	0.505
<b>Attitudes</b>					
T1	Using public buses is convenient and comfortable	0.784	0.025	30.916	0.651
T2	Using public buses is safe	0.710	0.03	23.989	0.505
T4	Using public buses helps save expenditure	0.760	0.027	28.497	0.577
<b>Subjective norm</b>					
T7	Your family thinks that you should have the students in your supervision go to school by public buses	0.795	0.043	18.171	0.617
T9	Most people surrounding you have the students in their supervision go to school by public buses	0.712	0.043	16.643	0.507
<b>Perceived behavioral control</b>					



**Table 2.5** Confirmatory factor analysis of theory of planned behavior toward public buses (public buses and motorcycles) (Continued)

	<b>Indicators</b>	<b>Estimate<sup>a</sup></b>	<b>SE</b>	<b>Est. /S.E.</b>	<b>R<sup>2</sup></b>
T10	The students in your supervision potentially use public bus service to go to school conveniently	0.795	0.029	27.773	0.633
T12	The students in your supervision potentially use public bus service to do other activities beyond going to school	0.698	0.032	21.946	0.566

a all indicators are significant at 0.001

$\chi^2/df = 1.811$ , RMSEA = 0.044, SRMR = 0.022, CFI = 0.989, and TLI = 0.981

**Table 2.6** Confirmatory factor analysis of theory of planned behavior toward public buses (public buses and private cars)

	<b>Indicators</b>	<b>Estimate<sup>a</sup></b>	<b>SE</b>	<b>Est. /S.E.</b>	<b>R<sup>2</sup></b>
<b>Intention</b>					
T13	The students in your supervision have intention to use public buses to go to school on a regular basis/most frequently	0.741	0.03	25.091	0.549
T14	The students in your supervision are more likely to go to school by public buses	0.722	0.031	23.613	0.521

**Table 2.6** Confirmatory factor analysis of theory of planned behavior toward public buses (public buses and private cars) (Continued)

	<b>Indicators</b>	<b>Estimate<sup>a</sup></b>	<b>SE</b>	<b>Est./S.E.</b>	<b>R<sup>2</sup></b>
T15	You attempt to have the students in your supervision to go to school by public buses next time/next semester	0.713	0.031	23.057	0.509
<b>Attitudes</b>		0.741	0.034	21.519	0.55
T1	Using public buses is convenient and comfortable				
T2	Using public buses is safe	0.681	0.036	18.727	0.464
T4	Using public buses helps save expenditure	0.651	0.038	17.047	0.424
<b>Subjective norm</b>					
T7	Your family thinks that you should have the students in your supervision go to school by public buses	0.698	0.031	22.376	0.487
T8	Most of the people in your community have the students in their supervision go to school by public buses	0.653	0.035	18.901	0.426

**Table 2.6** Confirmatory factor analysis of theory of planned behavior toward public buses (public buses and private cars) (Continued)

	<b>Indicators</b>	<b>Estimate<sup>a</sup></b>	<b>SE</b>	<b>Est./S.E.</b>	<b>R<sup>2</sup></b>
T9	Most people surrounding you have the students in their supervision go to school by public buses	0.725	0.03	24.023	0.525
<b>Perceived behavioral control</b>					
T10	The students in your supervision potentially use public bus service to go to school conveniently	0.74	0.039	18.787	0.547
T12	The students in your supervision potentially use public bus service to do other activities beyond going to school	0.605	0.041	14.757	0.366

a all indicators are significant at 0.001

$2/df = 2.733$ , RMSEA = 0.065, SRMR = 0.036, CFI = 0.958, and TLI = 0.939

#### **2.4.4 Structural Equation Model, Factors Influencing School Travel**

##### **Mode Choice of Public Buses and Motorcycles**

##### **Model Fit Indices**

In Figure , the results of consistency check of the fit model with the Mplus version 7 statistic program considering  $2 / df = 1.519$ , root mean square error

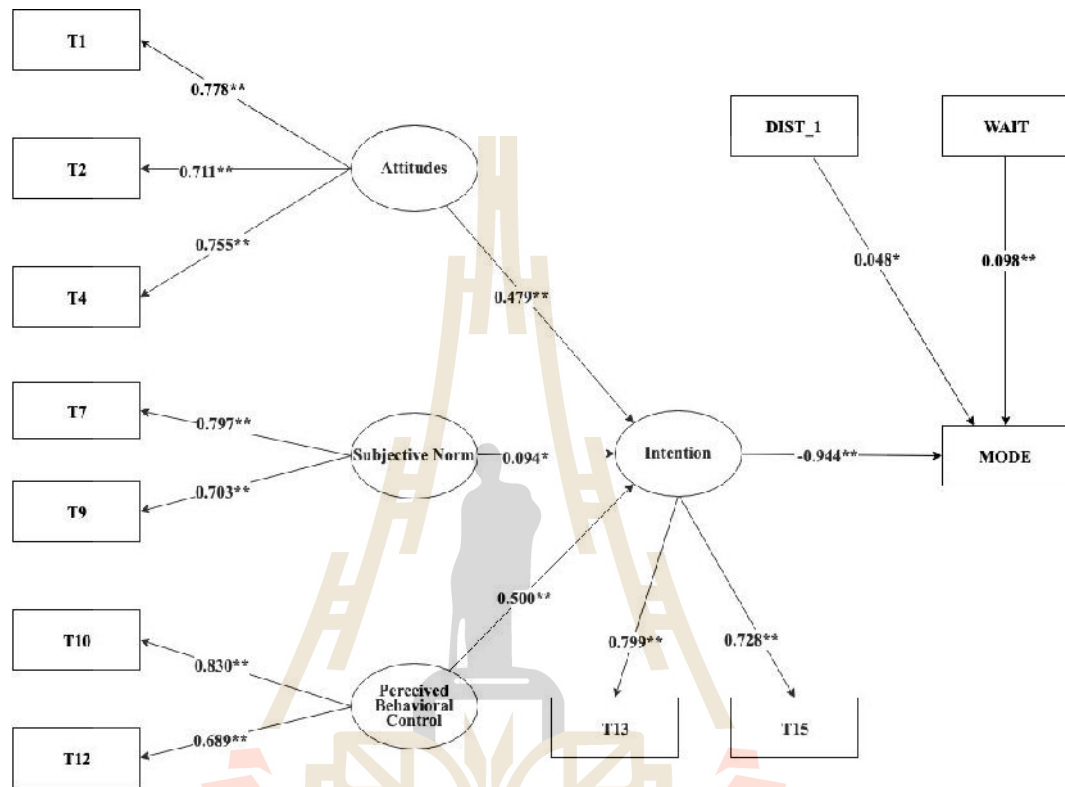
of approximation: RMSEA = 0.035, standardized root mean square residual: SRMR = 0.024, comparative fit index: CFI = 0.989, and the Tucker-Lewis index: TLI = 0.983; when compared to the criteria shown in Table 4, it shows that the structural equation model is consistent with the empirical data at a good level.

### Structural Path

In Figure , the intention in public bus school travel mode choice is directly influenced by attitudes toward the use of public buses ( $\beta = 0.479$ ) with a statistical significance level of 0.01, subjective norm in using public buses ( $\beta = 0.094$ ) with a statistical significance level of 0.05, and perceived behavioral control in using public buses ( $\beta = 0.500$ ) with a statistical significance level of 0.01. In other words, contributing to the attitudes, subjective norm, and perceived behavioral control in public buses use will influence the parents to have intention in public bus school travel mode.

In Figure , factors influencing motorcycle school travel mode choice (between public buses and motorcycle) revealed DIST\_1 (the distance between home and public bus boarding points) ( $\beta = 0.048$ ) with a statistical significance level of 0.05. In other words, the increase in distance between the house and boarding point will increase the motorcycle travel mode choice. That is, it will result in reducing public bus school mode choice. WAIT (waiting times for public buses) ( $\beta = 0.098$ ) has a statistical significance level of 0.01; that is to say, increasing waiting time for public buses will result in more motorcycle mode choice for school trips. In other words, it will result in reducing public bus mode choice. Intention to choose public buses for school trip ( $\beta = -0.944$ ) is statistically significant at the level of 0.01. In other words, increasing intention in choosing public buses for school trip will result in

fewer motorcycle mode choice for school trips or additional public bus school travel mode choice.



2/df = 1.519, RMSEA = 0.035, SRMR = 0.024, CFI = 0.989, TLI = 0.983,

\*p<0.05 and \*\*p<0.01

**Figure 2.1** Structural equation model, factors influencing school travel mode choice of public buses and motorcycles

#### 2.4.5 Structural Equation Model, Factors Influencing School Travel

##### Mode Choice of Public Buses and Private Cars

##### Model Fit Indices

In Figure , the results of consistency check of the fit model with the Mplus version 7 statistic program considering  $2 / df = 2.938$ , root mean square error

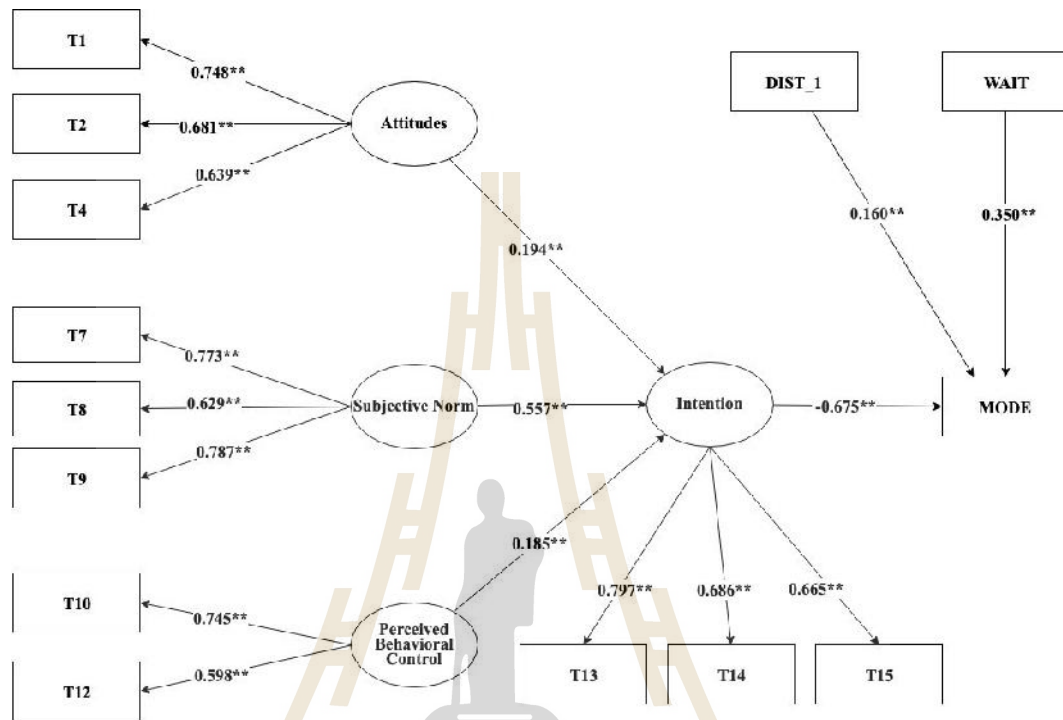
of approximation: RMSEA=0.069, standardized root mean square residual: SRMR = 0.063, comparative fit index: CFI = 0.927, and the Tucker-Lewis index: TLI = 0.901; when compared to the criteria shown in Table 4, it shows that the structural equation model is consistent with the empirical data at a good level.

### Structural Path

In Figure , the intention in public bus school travel mode choice is directly influenced by attitudes toward the use of public buses ( $\beta=0.194$ ) with a statistical significance level of 0.01, subjective norm in using public buses ( $\beta=0.557$ ) with a statistical significance level of 0.01, and perceived behavioral control in using public buses ( $\beta=0.185$ ) with a statistical significance level of 0.01. In other words, contributing to the attitudes, subjective norm, and perceived behavior control in public buses use will influence the parents to have intention in public bus school travel mode.

In Figure , factors influencing private cars school travel mode choice (between public buses and private cars) revealed that DIST\_1 (the distance between home and public bus boarding points) ( $\beta=0.160$ ) has a statistical significance level of 0.01. That is to say, the increase in distance between the house and boarding point will increase the private cars travel mode choice. In other words, it will result in reducing public bus school mode choice. WAIT (waiting times for public buses) ( $\beta=0.350$ ) is statistically significant at the level of 0.01; that is to say, increasing waiting time for public buses will result in more private cars mode choice for school trips. In other words, it will result in reducing public bus mode choice. Intention to choose public buses for school trip ( $\beta=-0.675$ ) is statistically significant at the level of 0.01. That is, increasing intention in choosing public buses for school trip will result

in fewer private cars mode choice for school trips or additional public bus school travel mode choice.



$2/df = 2.938$ ,  $RMSEA = 0.069$ ,  $SRMR = 0.063$ ,  $CFI = 0.927$ ,  $TLI = 0.901$ ,

\* $p < 0.05$  and \*\* $p < 0.01$

**Figure 2.2** Structural equation model, factors influencing school travel mode choice of public buses and private cars

## 2.5 Conclusions

This study aims to investigate and analyze the factors that influence students' school travel mode by using structural equations based on the theory of planned behavior in Mueang Nakhon Ratchasima District by considering the two groups of travel modes, namely, public buses and motorcycles and public buses and private cars. The considered factors consist of the distance between the house and the public

bus boarding point. The waiting time for public buses and the components of theory of planned behavior consist of attitudes, subjective norm, and perceived behavioral control and behavioral intention.

The results of the structural equation model analysis for public buses and motorcycles and public buses and private cars found that the distance between home and the public bus boarding points and the waiting time for waiting for public buses have a positive influence on the school travel mode choice of motorcycles and private cars at the statistical significance level of 0.01. In other words, if the distance from home to public bus boarding points and waiting time for public buses increases, it will result in higher parents' school travel mode choice of motorcycles and private cars. That is to say, it will result in the parents' decrease in public bus school travel mode. This is relevant to Napat (2013). In addition, the intention to choose public bus travel mode for school trip has the most negative influence on the school travel mode choice of motorcycles and private cars at the statistical significance level of 0.01. It was said that the importance and the intention in public bus travel mode choice will make parents decide to increasingly choose public buses for their children's school trips Chen and Lai (2011); Eriksson and Forward (2011); Lo et al. (2016). The intention in public bus school travel mode is influenced by positive attitudes toward public bus use at a statistical significance level of 0.01. This is consistent with Kamarudin et al. (2016); Liu et al. (2017); Morten et al. (2018). Subjective norm of public buses has a positive influence on the intention in public bus school travel mode choice at a statistical.



## 2.6 Acknowledgments

In this study, the researcher would like to thank the students' parents in Mueang District, Nakhon Ratchasima Province, for kindly answering the questionnaire, and Suranaree University of Technology for granting scholarships for a master's degree.

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## **CHAPTER I I I**

### **FACTORS INFLUENCING SCHOOL TRAVEL**

#### **MODE CHOICE IN THAILAND**

##### **3.1 Abstract**

The number of private cars and motorcycles continuously increases, causing traffic jams and pollution problems as well as accidents, especially around schools. Thus, public transportation systems may be a solution to these problems. The public bus is one of the public transportation systems accessible to students. The students' parents influence their choice of travel mode. This research aims to find factors influencing parents' decision to choose the school bus for their children. The questionnaires served as a data collection instrument for 1) parents' demographic, economic, and social characteristics, 2) choice of school travel mode and public bus travel model, and 3) plans to use the public bus. The sample group in this study was 680 high school parents in Muang district, Nakhon Ratchasima. The collected data were analyzed, using the Binary Logistic Regression method, under the Theory of Planned Behavior. The study ranks the positive influence factors in order of importance as follows: intention to use the public bus, the subjective norm in using the public bus, and attitude toward using the public bus. These factors can be used to define a transportation policy that encourages students to use public buses and reduce traffic jams around schools.

### 3.2 Introduction

In 2019, there were 39,160,454 registered vehicles (including 38,171,210 private cars and motorcycles) in Thailand, an increase of 3,554,953 since 2015 (Department of Land Transport, 2019b). The increasing number of vehicles causes traffic jams and pollution problems. In the Nakhon Ratchasima metropolitan area, a center of prosperity in economy, trade, service and other fields (Napat, 2013), the growing population has led to 1,336,960 more private cars and motorcycles (Department of Land Transport, 2019b). Areas around schools are especially crowded; most students travel to school (La Vigne, 2007) in private cars (54%), followed by public transportation (17%), school buses (15%), and motorcycles (14%) (Napat, 2013).

Besides traffic jams and air pollution effects, the problem with using personal vehicles around school areas is the risk of road accidents involving students (Morris et al., 2001). Thus, public transport management could solve this problem and create sustainable transportation creation (Intikhab Ahmed Qureshi & Huapu Lu, 2007). The public bus is one mode of public transportation systems accessible to students. Student's choice of travel mode should be understood to develop student bus use policies efficiently. A study of McMillan (2005) found that parents influences students' choice of travel mode.

The previous study was only focus on physical factors while the study of psychological factors also affect to the decision (M. Ben-Akiva & Boccara, 1987) and lead to more realistic explanation of the selection behavior (Moshe Ben-Akiva et al., 2002). Psychology theory widespread for describe human behavior, theory of planned behavior (Ajzen, 2006). This research aims to find factors influencing parents'

decision to let their children choose the public bus for traveling to schools in the Nakhon Ratchasima metropolitan area by studying psychological factors, using binary logistic regression, under the Theory of Planned Behavior framework. The research results have benefits for policymaking that encourages students to use public buses by promoting factors that affect the parents' decision-making behavior.

### 3.3 Psychological factors influencing mode choice behavior

The Theory of Planned Behavior was implemented successfully in many dimensions, including explanation of transport system using behavior Table presents examples of related research.

**Table 3.1** Related Research Works

Name	Objective	Method	Findings
Eriksson and Forward (2011)	Study factors influencing intention to three travel mode choices, namely, cars, public bus, and bicycle in Falun, Sweden	Hierarchical Regression Analyses	Attitudes, personal norm, and perceived behavioral control can explain intention to travel mode between 38% and 48%.
Long et al. (2011)	Study intention of motorcycle riders to use railway transport in the future in Phnom Penh, Cambodia.	Structural equation modeling	Behavioral control and attitude are forecasting factors of intention to use railway transport in the future.
Jomnonkwao, Sangphong, Khampirat, Siridhara, and Ratanavaraha (2016)	Study factors influencing public transport service quality and need for the transportation system in students	Second Order Confirmatory Factor Analysis	Factors influencing more using of public transport is attitude, personal norm and free of own private cars.



**Table 3.1** Related Research Works (Continued)

<b>Name</b>	<b>Objective</b>	<b>Method</b>	<b>Findings</b>
Kaewklengkrom, Satiennam, Jaensirisak, and Satiennam (2017)	Study psychological factors influencing mode choice behavior of Bus Rapid Transit (BRT) in Khon Kaen, Thailand	Hierarchical Regression Analysis	The intention of using BRT was mostly influenced by subjective norm and service factor e.g. travel duration time and travel fee.
Liu et al. (2017)	Study psychological factors influencing the intention to reduce car using in China.	Structural equation modeling	Perceived norm, attitude, perceived behavioral control affect behavioral intention to reduce car using.

### 3.4 Method

#### 3.4.1 Sample and survey

The sampled group in this study was 680 high school parents in the Muang district, Nakhon Ratchasima, which is higher than the calculation from 15 times of 21 variables,  $21 \times 15 = 315$  samples (T. F. Golob, 2003). The data was collected using the rating scale. There were three questionnaire sections: 1) parents' demographic, economics and social characteristics, 2) choice of school travel mode and public bus travel model, and 3) plans to use the public bus.

#### 3.4.2 Theory of Planned Behavior

The Theory of Planned Behavior was widely accepted to study the influence of attitude on changing behavior. The theoretical principal states that behavioral intention influences human behavior (Ajzen, 2005). Three factors influence human behavior (Ajzen, 1991): attitude, subjective norms, and perceived behavioral control

### 3.4.3 Binary logistic regression

This research applied binary logistic regression (LR) analysis to find factors influencing school travel mode choice and search the relationship between the dependent and independent variables. The dependent variable was binary, 1 and 0, which represented choosing or not choosing the public bus for travel to school. The independent variable is input as forward LR, which is the method of taking independent variables into equations one by one; the predicted variable selected into the equation predicts the probability of occurrence of an event of interest more accurately (Kaiyawan, 2012). The criteria for choosing the predictive variable is its highest correlation value and significance.

Table provides dependent and independent variables.

**Table 3.2** Details of variable coding

Acronym	Variables	Description
Y	Choosing of public bus for traveling to school	1 = Choose public bus 0 = Not choose public bus
DIST_1	Distance between home and the bus stop.	1 = less than 0.5 km., 2 = 0.5–1 km. 3 = 1.1–1.5 km. 4 = 1.6–2 km. 5 = 2.1–2.5 km. 6 = more than 2.5 km.
WAIT	Time duration for waiting for public bus.	1 = less than 10 minutes. 2 = 10–20 minutes. 3 = 21–30 minutes. 4 = more than 30 minutes.
POINT	Connection hops of public bus to school	1 = 1 hop 2 = 2 hops 3 = more than 2 hops
COST	Public bus round trip fee between home and school.	1 = less than 10 baht 2 = 10–20 baht 3 = 21–30 baht 4 = more than 30 baht
DIST_2	Round trip distance between home and school.	1 = less than 5 km 2 = 5–10 km 3 = 11–15 km 4 = 16–20 km 5 = 21–25 km 6 = 26–30 km 7 = 31–35 km 8 = more than 35 km
TIME	Round trip time duration between home and school by public bus.	1 = less than 10 minutes 2 = 10–20 minutes 3 = 21–30 minutes 4 = 31–40 minutes 5 = 41–50 minutes 6 = more than 50 minutes

**Table 3.2** Details of variable coding (Continued)

<b>Acronym</b>	<b>Variables</b>	<b>Description</b>	<b>Acronym</b>
<b>ATT</b>	<b>Attitude toward using public bus.</b>		
X1	Comfortability of using public bus.	1 = Strongly disagree	
X2	Safety of using public bus.	2 = Disagree	
X3	Satisfaction of using public bus.	3 = Undecided	
X4	Saving cost when using public bus	4 = Agree	
X5	Reduce pollution and environmental problem when using public bus	5 = Strongly agree	
<b>SUB</b>	<b>Subjective norm toward using public bus.</b>		
X6	Your friends think that you should let students under your support go to school by public bus.	1 = Strongly disagree 2 = Disagree 3 = Undecided 4 = Agree 5 = Strongly agree	
X7	Your family members think that you should let students under your support go to school by public bus.		
X8	Most of people in your community allow students under their support go to school by public bus.		
X9	People around you let students under their support go to school by public bus.		
<b>PER</b>	<b>Behavioral perceive of using public bus.</b>		
X10	Students under your support can conveniently use public bus service to go to school.	1= Strongly disagree 2 = Disagree	
X11	Using public bus service to go to school is easy for students under your support	3 = Undecided 4 = Agree 5 = Strongly agree	
X12	Except go to school, students under your support can use public bus service to travel to other places.		
<b>INTEN</b>	<b>Intention to use public bus.</b>		
X13	Students under your support intent to “always/most frequent” go to school by public bus.	1=Strongly disagree 2=Disagree 3=Undecided	
X14	Students under your support tend to go to school by public bus.	4=Agree 5=Strongly agree	
X15	You intend to let students under your support go to school by public bus in the next time/next semester.		

## 3.5 Results

### 3.5.1 Descriptive Statistic

The data on factors influencing school travel mode were obtained from 680 parents. Their demographic, economic, and social characteristics were presented as follows: Students under their support were 48% male and 52% female, 59% are between 13-15 years old, 41% are between 16-18 years old, 59% are in junior high school level, 41% are in high school/vocational level. The parents who answered the questionnaire are 45% male, 55% female, 54% are between 40-49 years (highest part), 62% have 2-3 family members, and 34% of parents had a bachelor's degree. The average income of 29% of parents was between 30,000 – 39,999 baht income, and most (76%) worked full time. Most (92%) owned motorcycles, followed by personal cars (73%). Most (87%) had a motorcycle-driving license, followed by a personal car-driving license (70%). The largest (55%) mode of travel was personal car. In terms of school travel mode, the highest rank (40%) was by motorcycle, followed by personal car (39%) and public bus (21%).

Table shows descriptive statistical data of school travel mode choice, which are mean, standard deviation, variance, skewness, and kurtosis. It was found that the data has normal distribution because SK value was between -3.0 and +3.0 with KU value was lower than 10.0 (R. B. Kline, 2011).

**Table 3.3** Descriptive statistical data of school travel mode choice.

Variables	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	Kurtosis
Y	0	1	0.216	0.4119	0.17	1.382	-0.09
DIST_1	1	6	2.471	1.1509	1.325	0.895	0.384
WAIT	1	4	2.01	0.5133	0.264	0.213	1.567
POINT	1	2	1.257	0.4375	0.191	1.113	-0.765
COST	2	4	2.61	0.837	0.701	0.835	-1.057
DIST_2	1	8	2.899	1.5692	2.462	1.432	2.341
TIME	1	6	2.718	1.1777	1.387	0.806	0.527
X1	1	5	2.991	1.3794	1.903	-0.031	-1.223
X2	1	5	2.826	1.2278	1.507	0.109	-0.829
X3	1	5	2.959	1.2721	1.618	-0.06	-0.96
X4	1	5	3.165	1.3856	1.92	-0.094	-1.181
X5	1	5	3.244	1.3781	1.899	-0.147	-1.276
X6	1	5	3.328	1.1677	1.364	-0.471	-0.728
X7	1	5	3.453	1.1019	1.214	-0.423	-0.483
X8	1	5	3.374	0.9656	0.932	-0.549	-0.325
X9	1	5	3.503	1.1332	1.284	-0.284	-0.613
X10	1	5	2.738	1.2181	1.484	0.089	-0.951
X11	1	5	2.941	1.2085	1.46	-0.058	-0.842
X12	1	5	2.847	1.2705	1.614	0.22	-0.924
X13	1	5	2.96	1.1201	1.255	0.066	-0.757
X14	1	5	2.918	1.0135	1.027	-0.141	-0.623
X15	1	5	2.74	1.422	2.022	0.281	-1.204

### 3.5.2 Analyzation result of correlation coefficient between variables

Table presents analytical results of the correlation coefficient between variables of school travel mode choice. The results were used to consider possible multicollinearity problems by defining the correlation coefficient values between variables lower than 0.70 (Schroeder, Lander, & Levine-Silverman, 1990)

**Table 3.4** Analyzation results of the correlation coefficient between variables of school travel mode choice.

	Y	DIST_1	WAIT	POINT	COST	DIST_2	TIME	ATT	SUB	PER	INTEN
Y	1										
DIST_1	-0.3	1									
WAIT	-0.17	0.09	1								
POINT	-0.19	0.14	0.06	1							
COST	-0.21	0.17	0.03	0.85	1						
DIST_2	0.03	-0.16	0.18	0.38	0.44	1					
TIME	-0.02	-0.19	0.23	0.23	0.27	0.74	1				
ATT	0.47	-0.07	-0.11	-0.25	-0.24	-0.11	-0.06	1			
SUB	0.48	-0.28	-0.05	-0.05	-0.05	0.09	-0.01	0.31	1		
PER	0.46	-0.14	-0.17	-0.15	-0.14	-0.05	-0.03	0.51	0.37	1	
INTEN	0.64	-0.11	-0.13	-0.21	-0.22	-0.09	-0.1	0.55	0.39	0.56	1

### 3.5.3 Independent variable model influencing school travel mode choice

For the independent variable model influencing school travel mode choice, the suitable testing result, using the Hosmer and Lemeshow method, found that the statistical Chi-Square = 11.228 at P-value = 0.189. This could not refute hypothesis  $H_0$  at 0.05 significant value. The data from this study can present a relationship to the binary logistic regression model. Besides, the Omnibus test result found that P-value < 0.01, which meant at least one independent variable influenced school travel mode choice in the Nakhon Ratchasima metropolitan area.

Equation 1 is probability go to school by public bus and Equation 2 indicates that the intent to use a public bus factor significantly influenced the choice of travel mode to school at 0.01 by the highest increment coefficient at 1.905. The subjective norm toward using public bus factor followed, at statistically significant 0.01 by the increment coefficient at 1.271. The attitude toward using a public bus

factor was statistically significant 0.01 by the increment coefficient at 0.705. These are the forecasting equation form as follows:

$$\text{Probability}_{go\ to\ school\ by\ public\ bus} = \frac{1}{1+e^{-Z}} \quad (3.1)$$

$$Z = -14.984 + 0.705ATT + 1.271SUB + 1.905INTEN \quad (3.2)$$

From Table , considering the Odd ratio value from Exp (B) value, it was found that, if the parents' attitude toward using the public bus increased one unit, this would affect the possibility of parents letting their children go to school by bus increased 2.024 times. Moreover, the one-unit increment of the parents' subjective norm (e.g. family, friends, and community members) meant the likelihood that parents would let their children go to school by bus increased 3.565 times. Finally, the one-unit increment of the intention to use the public bus to go to school increased the likelihood of parents letting their students go to school by bus 6.718 times.

**Table 3.5** Independent variable influencing school travel mode choice.

Variables	B	S.E.	Wald	df	Sig	Exp(B)
ATT	0.705	0.19	13.748	1	<0.01	2.024
SUB	1.271	0.224	32.162	1	<0.01	3.565
INTEN	1.905	0.234	66.507	1	<0.01	6.718
Constant	-14.984	1.241	145.874	1	<0.01	0

### 3.6 Conclusions and implementation

This study of factors influencing parents' decision to let their children go to school by public bus found three factors influenced their decision. There were attitude toward using a public bus (Eriksson & Forward, 2011; Jomnonkwo et al., 2016;

Long et al., 2011), subjective norm toward using a public bus (Kaewkluengkrom et al., 2017), and plans to use a public bus (Stark, Berger, & Hössinger, 2018). Three factors positively influenced using the public bus, which related to Heath and Gifford (2002)'s study.

The above factors can be used as a guideline for making transportation policy to support student use of the public bus as follows:

1. Attitude toward using a public bus: Campaigns and promotions which focus on the advantages of using the public bus, e.g., comfort, safety, cost-saving, and environmental preservation.

2. Subjective norm toward using public bus: Friends, community members, and family members influenced using the public bus to travel to school. The activity, which encourages community member use the public bus to go to school, should be presented.

3. Intent to use a public bus: Encouraging parents to let their children go to school by public bus by giving higher privileges to public buses, for example, public buses can park in the school area, but other vehicles are prohibited.

### **3.7 Acknowledgment**

In this study, the researcher would like to thank the students' parents in Mueang District, Nakhon Ratchasima Province for kindly answering the questionnaire, and Suranaree University of Technology for granting scholarships for a master's degree.



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**CHAPTER I**

**INFLUENCING FACTOR USE PUBLIC BUS OF TRAVEL**

**TO SCHOOL: USING STRUCTURAL EQUATION**

**MODELING FOR THE THEORY OF THE HEALTH**

**BELIEF MODEL**

**4.1 Abstract**

Thailand has a continuously increasing number of personal cars and motorcycles resulting in traffic congestion and pollution. Nakhon Ratchasima is one of the cities that encounter such problems especially in school areas. Therefore, the public transport system is a solution to these problems. The objective of this study is to study the factors that influence the public buses as students' travel mode choice to school by using the structural equation model according to Health belief theory. Data collection was conducted by self-responding questionnaires from 636 samples of parents, whose children are studying at a secondary level in Mueang Nakhon Ratchasima District. It was found that Cues to Action ( $\beta = 0.991$ ) had most influence on the mode choice of public buses, followed by Perceived Barriers ( $\beta = -0.795$ ) not having influence on using public buses, and (Health motivation) ( $\beta = 0.500$ ) had influence on the public bus mode choice. The research results can be used as guidelines for planning to encourage students to use more public transportation to go to school.

## 4.2 Introduction

In 2019, Thailand has increasingly registered by 3,554,953 vehicles from 2015 (Department of Land Transport, 2019b) causing traffic congestion and pollution. Nakhon Ratchasima is an area in Thailand with commercial economic, service and education centers (Napat, 2013) causing traffic overcrowding, especially in school areas, where parents take their children to and back from. This results in the use of private cars and motorcycles (La Vigne, 2007). A public bus which is a form of public transportation students can access to go to study is therefore potentially used for traffic jam solution (Intikhab Ahmed Qureshi & Huapu Lu, 2007). This study has developed a policy empowering student to use public buses more efficiently. According to the previous studies focusing only on physical factors affecting decision-making (M. Ben-Akiva & Boccara, 1987) and leading to a more realistic explanation of selection behavior (Moshe Ben-Akiva et al., 2002) by using health belief theory, McMillan (2005) found that parents' decisions had a direct influence on the students' mode choice travel. Thus, this research aims to study the factors influencing the mode choice of public buses for students as well as its development of structural equation modeling of students' public transport mode choice based on parents' decisions.

## 4.3 Materials and Methods

### 4.3.1 Health belief model

Health belief model is the plan developed from Lewin (1951) 's psychological theory to explain disease prevention behaviors. Later, it was developed to describe patient behavior in practice. To explain, a person will execute the behavior

to avoid having an illness, that person must believe that 1) they are at risk of getting a disease 2) the disease is life-threatening, and 3) the practice for illness avoidance potentially leads to good consequences helping reduce the risk and severity of the disease according to the doctors' advice. (Rosenstock, 1974). Later, Maiman and Becker (1974) improved the health belief model to be used to describe preventive behaviors of individuals. The model consists of Perceived Susceptibility, Perceived Severity, Perceived Benefits, Perceived Barriers, Modifying Factor, and Cues to Action. The health belief on seat belt use (Abate, 2018), the study on motor vehicle driving behavior (Morowatisharifabad, 2009; Özkan, Lajunen, Do ruyol, Yıldırım, & Çoymak, 2012), the study on motorcycle helmet use (Zavareh, Hezaveh, & Nordfjærn, 2018), the study of travel behavior (Masoumi, 2019; Rostam & Noor, 2014; Wan Omar, Patterson, & Pegg, 2013)

#### **4.3.2 Structural equation modeling**

Structural Equation Modeling is a model established to show the relationship between latent and latent variables, as well as the relationship between latent and observable variables by Factor Analysis, Path Analysis and Parameter estimation in regression analysis consisting of the Measurement Model and the Structural Model (Hair, 2010)

#### **4.3.3 Data Collection**

This study collected data from parents of secondary school students studying in the district of Mueang Nakhon Ratchasima (The Office of Academic Promotion and Registration, 2019)a, using Stratified Random Sampling distributed by school. T. Golob (2003)proposed the number of sample group at least 15 times of observable variables when creating structural equations Therefore, this study should

have at least 270 samples and in order to prevent data loss, 636 backup data have been collected, which are considered sufficiency for structural equation model analysis.

#### 4.3.4 Questionnaire

In this research, the researcher used self-Administered Questionnaire to collect the questionnaires. The questionnaire consists of 2 parts including Part 1: Personal Information Parents' socioeconomic characteristics and students' school mode travel, Part 2: Health belief Model on public bus use is a Rating Scale based on the Linker Scale, divided into 5 levels, which are: strongly agree, agree, not sure, disagree, strongly disagree, the highest score is determined as 5 and the lowest score is 1. The variables can be summarized, as shown in Table 4..

**Table 4.1** Details of variable coding

Variable name	Definition of variable	Description
MODE	Choosing of public bus for traveling to school	0= Not choose public bus 1= Choose public bus
<b>Perceived Susceptibility</b>		
H1	Standing on public transport is at risk of accident.	1=Strongly disagree 2=Disagree
H2	Standing outside of a public bus while traveling is at risk of an accident.	3=Undecided 4=Agree
H3	Using public buses is at risk of accidents crashing against other vehicle types.	5=Strongly agree
H4	When public buses use over speed limit; it may cause fatal accidents.	

**Table 4.1** Details of variable coding (Continued)

<b>Variable name</b>	<b>Definition of variable</b>	<b>Description</b>
<b>Perceived Severity</b>		
H5	Possibly leading to death	1=Strongly disagree
H6	Possibly leading to disability or requiring long-term treatment	2=Disagree 3=Undecided
H7	Possibly affecting his/her study	4=Agree
H8	Possibly affecting the way of life of involved persons, such as friends, relatives, family, etc.	5=Strongly agree
<b>Perceived Benefits</b>		
H9	You feel comforted when students in your supervision go to school by public buses.	1=Strongly disagree 2=Disagree
H10	You feel comforted when your students in your supervision follow the regulations and suitability of public buses.	3=Undecided 4=Agree 5=Strongly agree
<b>Perceived Barriers</b>		
H11	Public buses have insufficient seats	1=Strongly disagree
H12	The unstable public transport timetable causes your supervised student to be delayed.	2=Disagree 3=Undecided
H13	Public transport fares are expensive for students in your supervision	4=Agree 5=Strongly agree
H14	Public buses do not provide sufficient bus services.	



**Table 4.1** Details of variable coding (Continued)

<b>Variable name</b>	<b>Definition of variable</b>	<b>Description</b>
<b>Cues to Action</b>		
H15	Your child's friend goes go to school by public bus.	1=Strongly disagree 2=Disagree
H16	Your family taught you to use public buses when you were a child.	3=Undecided 4=Agree 5=Strongly agree
H17	Your community is encouraged to use public buses for school-travel mode.	
H18	You see advertising media, posters which support school-travel by public buses.	
<b>Health Motivation</b>		
H19	Health is the most important thing for students in your supervision.	1=Strongly disagree 2=Disagree
H20	It is the worst case when students in your supervision have car or road accidents.	3=Undecided 4=Agree
H21	You place a lot of importance on the safety of students in your supervision when using vehicles.	5=Strongly agree

## 4.4 Results and Discussion

### 4.4.1 Sample Characteristics

The data on factors influencing school travel mode were obtained from 636 parents. Their demographic, economic, and social characteristics were presented as follows: Students under their support were 45% male and 55% female, 57% are

between 13-15 years old, 43% are between 16-18 years old, 57% are in junior high school level, 43% are in high school/vocational level. The parents who answered the questionnaire are 46% male, 54% female, 39% are between 40-49 years (highest part), 60% have 2-3 family members, and 32% of parents had a bachelor's degree. The average income of 30% of parents was between 30,000 – 39,999 baht income, and most (76%) worked full time. Most (92%) owned motorcycles. Most (86%) had a motorcycle-driving license. The largest (51%) mode of travel was personal car. In terms of school travel mode, the public bus (21%).

#### 4.4.2 Descriptive Statistics

From Table showing descriptive statistical data, the public transport mode choice to school consisting of Mean, Standard deviation, Variance, Skewness, and Kurtosis, it was found that the data are Normal Distribution since when considering the SK value, it should be in the range -3.0 to +3.0 and the KU value should be lower than 10.0 (Rex B. Kline, 2011).

**Table 4.2** Descriptive statistics

	<b>Mean</b>	<b>Std. Deviation</b>	<b>Variance</b>	<b>Skewness</b>	<b>Kurtosis</b>
H1	3.413	1.4859	2.208	-0.392	-1.283
H2	3.562	1.4299	2.045	-0.486	-1.173
H3	3.353	1.45	2.102	-0.31	-1.281
H4	3.452	1.4803	2.191	-0.43	-1.238
H5	3.342	1.4423	2.08	-0.28	-1.284
H6	3.387	1.4246	2.029	-0.366	-1.192
H7	3.389	1.4058	1.976	-0.303	-1.226
H8	3.34	1.4399	2.073	-0.289	-1.265
H9	3.348	1.362	1.855	-0.339	-1.086
H10	3.331	1.4278	2.039	-0.341	-1.224
H11	3.48	1.4189	2.013	-0.417	-1.209
H12	3.417	1.361	1.852	-0.416	-1.057
H13	3.269	1.3683	1.872	-0.22	-1.164
H14	3.422	1.3555	1.837	-0.431	-1.008

**Table 4.2** Descriptive statistics (Continued)

	<b>Mean</b>	<b>Standard Deviation</b>	<b>Variance</b>	<b>Skewness</b>	<b>Kurtosis</b>
H15	3.269	1.4565	2.121	-0.232	-1.33
H16	3.361	1.4233	2.026	-0.357	-1.2
H17	3.335	1.4218	2.021	-0.342	-1.184
H18	3.249	1.4487	2.099	-0.196	-1.331
H19	3.498	1.4532	2.112	-0.428	-1.264
H20	3.492	1.4811	2.194	-0.476	-1.239
H21	3.516	1.4444	2.086	-0.483	-1.143

#### 4.4.3 Confirmatory Factor Analysis

From the Confirmatory factor analysis of the Health Belief Model on public bus mode choice for school trips with the Mplus version 7 program, Table showing the modelling harmony components value  $\chi^2 / df = 1.646$ , when compared to the criteria shown in Table , it shows that the model is in good consistency. The latent variables are consistent with the question items of indicators and the Health Belief Model which can be used for Structural equation modeling analysis.

**Table 4.3** Criterion of model fit indices

<b>Model fit indices</b>		<b>Acceptable limits</b>	<b>References</b>
Chi-square	$\chi^2$	$\chi^2/df \leq 5$	(Deb & Ahmed, 2018)
Degrees of freedom	df		
Root mean square error of approximation	RMSEA	0.08	(Deb & Ahmed, 2018; Hu et al., 2015)
Comparative fit index	CFI	> 0.9	(Deb & Ahmed, 2018; Hu et al., 2015)
Tucker-Lewis index	TLI	> 0.8	(Hooper et al., 2008)
Standardized root mean residual	SRMR	0.08	(Schreiber, Nora, Stage, Barlow, and King, 2006)

**Table 4.4** Confirmatory factor analysis of Health belief model toward public buses

	<b>Estimate</b>	<b>SE</b>	<b>Est./S.E.</b>	<b>P-Value</b>	<b>R2</b>
<b>Perceived Susceptibility</b>					
H1	0.790	0.016	48.428	0.001	0.625
H2	0.783	0.017	47.247	0.001	0.613
H3	0.771	0.017	44.250	0.001	0.595
H4	0.780	0.017	46.485	0.001	0.608
<b>Perceived Severity</b>					
H5	0.795	0.016	48.913	0.001	0.632
H6	0.772	0.018	43.602	0.001	0.596
H7	0.806	0.015	52.211	0.001	0.650
H8	0.753	0.019	40.463	0.001	0.567
<b>Perceived Benefits</b>					
H9	0.741	0.022	34.111	0.001	0.549
H10	0.798	0.020	40.656	0.001	0.636
<b>Perceived Barriers</b>					
H11	0.773	0.017	44.625	0.001	0.598
H12	0.745	0.019	38.555	0.001	0.555
H13	0.655	0.024	27.189	0.001	0.428
H14	0.743	0.020	37.966	0.001	0.553
<b>Cues to Action</b>					
H15	0.807	0.016	50.406	0.001	0.652
H16	0.78	0.018	44.172	0.001	0.609
H17	0.762	0.019	40.277	0.001	0.581
H18	0.73	0.021	35.346	0.001	0.533
<b>Health Motivation</b>					
H19	0.811	0.016	51.177	0.001	0.657
H20	0.780	0.018	44.131	0.001	0.609
H21	0.806	0.016	49.665	0.001	0.650

2/df = 1.646, RMSEA = 0.032, SRMR = 0.019, CFI = 0.988, and TLI = 0.985

#### 4.4.4 Structural Equation Model

##### Model Fit Indices

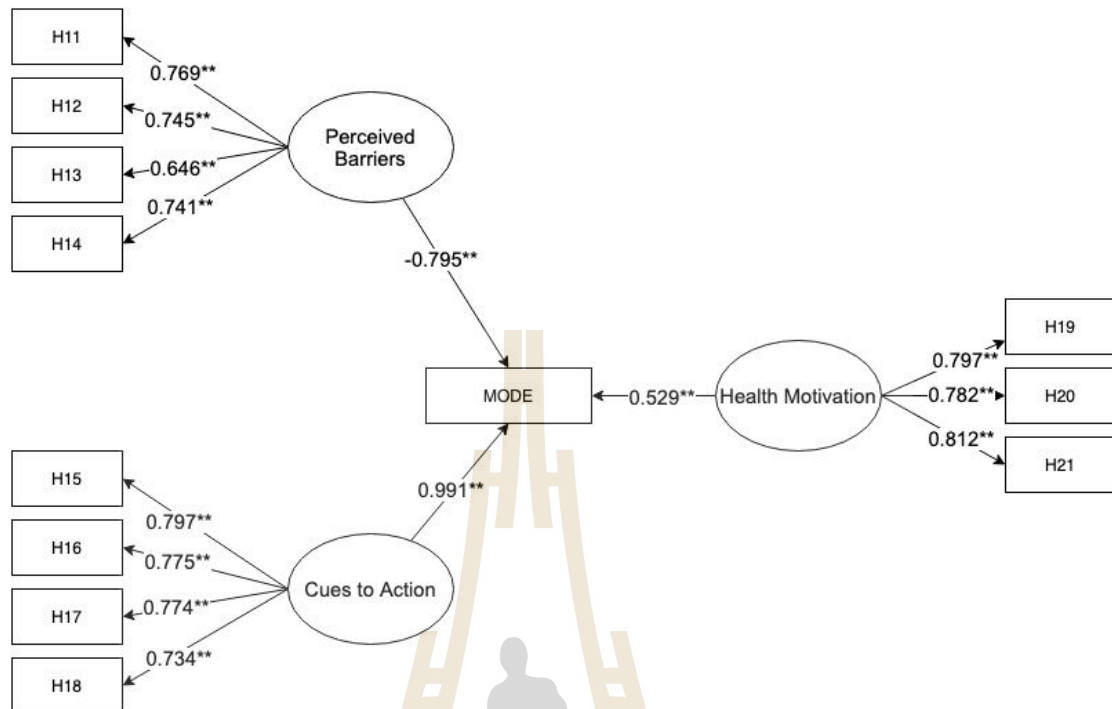
In

Figure , the results of consistency check of the fit model with the Mplus version 7 statistic program considering  $\chi^2 / df = 1.417$ , root mean square error of approximation: RMSEA = 0.026, standardized root mean square residual: SRMR = 0.019, comparative fit index: CFI = 0.995, and the Tucker-Lewis index: TLI = 0.994; when compared to the criteria shown in Table , it shows that the structural equation model is consistent with the empirical data at a good level.

##### Structural Path

According to

Figure , from the analysis of the Structural Equation Modeling, choosing public buses for school trips under the Health Belief Model, it was found that the school travel mode choice of public buses was directly influenced by the three components including Perceived Barriers ( $\beta = -0.795$ ) with statistical significance at the 0.01 level. In other words, when parents perceived the obstacles in using public buses, this resulted in the decrease in public transport mode choice, Cues to Action ( $\beta = 0.991$ ) with statistical significance at the 0.01 level. That is to say, when the parents were aware of what induces into practice, this resulted in the increase in mode choice of public buses, and Health motivation ( $\beta = 0.500$ ) with statistical significance at the 0.01 level. To explain, when parents increasingly recognized the motivation of Health in public transport, the travel mode choice of public buses consequently increased.



$2/df = 1.417$ ,  $RMSEA = 0.026$ ,  $SRMR = 0.019$ ,  $CFI = 0.995$ , and  $TLI = 0.994$

\* $p < 0.05$  and \*\* $p < 0.01$

**Figure 4.1** Structural equation modeling for the theory of the health belief model, influencing factor use public bus of travel to school.

## 4.5 Conclusions

This study aims to study and analyze the factors influencing the students' school- travel by public transport in Mueang Nakhon Ratchasima District using the structural equations according to the theory of Health belief model. It consists of Cues to Action which has most influence on the public bus - when people around their parents such as friends' children, parents' family as well as people in the community, and advertising media which encourage students to go to school by public buses, the school-travel mode choice of public buses increases; Perceived Barriers, to describe,

when public buses have insufficient seats, the public bus timetable is uncertain, public transport fares are expensive and the services of public transportation are not thoroughgoing, travel-to-school by public transport mode choice reduces accordingly; and Health motivation, referring to the focus on health and safety, which includes the awareness of the parents' recognition of the motivation of Health in public transport results in the increase in school-travel mode choice of public buses (Abate, 2018; Rostam & Noor, 2014; Wan Omar et al., 2013).

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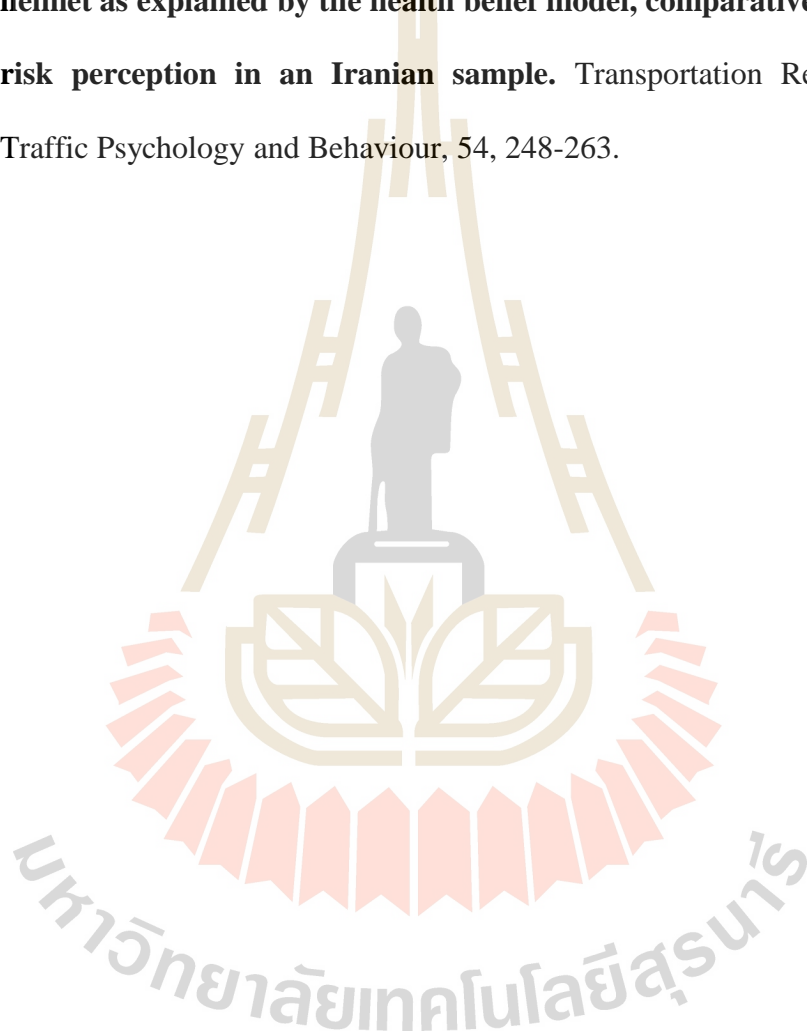
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## CHAPTER V

### CONCLUSION AND RECOMMENATIONS

Thailand is ranked as an overcrowded country in the world and Nakhon Ratchasima is an area in Thailand that experiences the problem because it is a center of prosperity, service, and education, especially in the school area where many students use personal vehicles to go. The number of private cars and motorcycles continuously increases, causing traffic jams and pollution problems as well as accidents, especially around schools. Thus, public transportation systems may be a solution to these problems., this research has conducted 3 studies to investigate factors for school-travel mode choice.

#### **5.1 Factors influencing mode of travel to school: a case study of Nakhon Ratchasima**

Study 1: This study aims to investigate and analyze the factors influencing the students' mode of travel to school by public buses and develop the structural equation modeling of students' public bus mode choice for school trip. From the model of factors influencing motorcycle mode choice for school trip (between public buses and motorcycles), it was found that the behavioral intention to choose public buses to school has the most effect ( $\beta = -0.944$ ), which is influenced by the attitudes, subjective norm, and perceived behavioral control in using public buses. In addition, the model of factors influencing private car mode choice to school (between public

buses and private cars) showed that behavioral intention to choose public buses for school trip has the most effect ( $\beta = -0.675$ ), which is influenced by the attitudes, subjective norm, and perceived behavioral control in using public buses. The results of this research can be the guidelines for planning to promote students to public transport use for school trip.

## **5.2 Factors influencing school travel mode choice in Thailand**

Study 2: This research aims to find factors influencing parents' decision to choose the school bus for their children. Using the Binary Logistic Regression method, under the Theory of Planned Behavior. The study ranks the positive influence factors in order of importance as follows: intention to use the public bus, the subjective norm in using the public bus, and attitude toward using the public bus. These factors can be used to define a transportation policy that encourages students to use public buses and reduce traffic jams around schools.

## **5.3 Influencing factor use public bus of travel to school: using structural equation modeling for the theory of the health belief model**

Study 3: The objective of this study is to study the factors that influence the public buses as students' travel mode choice to school by using the structural equation model according to Health belief theory. It was found that Cues to Action ( $\beta = 0.991$ ) had most influence on the mode choice of public buses, followed by Perceived Barriers ( $\beta = -0.795$ ) not having influence on using public buses, and (Health motivation) ( $\beta = 0.500$ ) had influence on the public bus mode choice. The research

results can be used as guidelines for planning to encourage students to use more public transportation to go to school.

#### **5.4 Recommendations**

This study focuses on the factors influencing the school-travel mode choice by public buses in terms of reducing the use of private vehicles and encouraging the public bus use under the conceptual framework of The Theory of Planned Behavior, and the Theory of Health belief Model. Accordingly, there are two propositions including:

The policy encouraging students to use public buses under the conceptual framework of the Theory of Planned Behavior consisting of Attitude toward using a public bus: Campaigns and promotions which focus on the advantages of using the public bus, e.g., comfort, safety, cost-saving, and environmental preservation.

Subjective norm toward using public bus: Friends, community members, and family members influenced using the public bus to travel to school. The activity, which encourages community member use the public bus to go to school, should be presented. Intent to use a public bus: Encouraging parents to let their children go to school by public bus by giving higher privileges to public buses, for example, public buses can park in the school area, but other vehicles are prohibited.

The policy encouraging students to use public buses under the conceptual framework of the Theory of Health Belief Model consisting of Cues to Action, Perceived Barriers, Health motivation. The policy to focus on health, safety and advertising media which encourage students to go to school by public buses, The management public buses have sufficient seats, the public bus timetable is certain,

public transport fares are reasonable price and services of public transportation thoroughgoing.



## **BIOGRAPHY**

Mr. Chinnakrit Banyong was born on the 12 of August, 1994 at Bangkok. He started his secondary education at Boonwattana school. Then, he further studied Bachelor's degree in Transportation and logistics Engineering Institute of Engineering at Suranaree University of Technology, he was the student who had the First-class honors, Gold medal of bachelor's degree curriculum, he was selected to win the scholarship of achieving to master degree in Transportation Engineering at Suranaree University of Technology.

His expertise includes the field of the transport engineering research and statistics models. During his Master's degree study, he presented two presentation entitled "FACTORS INFLUENCING SCHOOL TRAVEL MODE CHOICE IN THAILAND" at 14th South East Asian Technical University Consortium Symposium at King Mongkut's University of Technology Thonburi, Thailand (SEATUC 2020). And "INFLUENCING FACTOR USE PUBLIC BUS OF TRAVEL TO SCHOOL: USING STRUCTURAL EQUATION MODELING FOR THE THEORY OF THE HEALTH BELIEF MODEL" at The 3rd Conference on Innovation Engineering and Technology for Economy and Society at Kasem Bundit University, Thailand. And published one papers entitled of "FACTORS INFLUENCING MODE OF TRAVEL TO SCHOOL: A CASE STUDY OF NAKHON RATCHASIMA" in Suranaree Journal of Science and Technology (SJST).