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Empirical Analysis of Road Safety Behaviours of School-going Children Using Structural Equation Modelling: A Perspective from India

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Abstract

The behaviour of children in traffic are functions of knowledge, attitude and risk perception. This study is attempted to find the major road safety related problems faced by children on their way to school and to identify and evaluate the important factors which affect the road safety behaviour among school going children using different transport modes. The data was collected from 1224 students studying from class 7th to 12th in India The results show that problems faced by children using different transport modes, traffic misbehaviour from elders, and performance of children's risky behaviours. Road safety knowledge among students, their attitude towards road safety, and risk perception about various dangerous situations need to be enhanced. Text books are the least source of traffic safety information, indicating the necessity of including traffic safety lessons as mandatory in school syllabus by making use of modernized techniques.

Keywords: Road Safety; Road Safety Education; Children; Risky Behaviours; Traffic Accidents

1. Introduction

Traffic crashes are regarded as one of the world's most painful problems, and contribute to the main leading of injuries and fatalities in the 0- 19 age group (Branche et al., 2008). In India, traffic crashes are the second most primary cause of fatalities for

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students who aged 5 to 14 years (Dandona et al., 2011), and more than half of fatalities is related to children (Singh & Aggarwal, 2010). This could be explained by the fact that they are in the process of physical and cognitive development which continue to develop until young adulthood (Peden et al., 2004). Accidents have been found among Indian adolescents who use different transport modes, including walking, bikes, two wheelers, cars, private/public buses, and rickshaw to go to schools (Jaiswal et al., 2006; Jha et al., 2003; Meena et al., 2014; Mohan, 2004; Singh & Aggarwal, 2010; Swami et al., 2006; Tetali et al., 2016).

Road safety education has been used to enhance traffic safety for students in many countries (Dragutinovic & Twisk, 2006). When appropriate teaching methods were employed, traffic safety education demonstrated its major contributions to raising knowledge of traffic signs and situation awareness (Fyhri et al., 2004). Traffic crashes are more likely to occur among students who exhibit higher levels of hazardous behavior and less awareness of traffic rules (Twisk et al., 2014).

Attitude which turns knowledge into action is also one of the most important elements influencing driving behavior (Jafarpour & Rahimi-Movaghar, 2014). Road users who have negative attitudes towards traffic safety tend to show more risky behaviours on roads (Nabi et al., 2007). Therefore, attitude could be used to predict risky behaviours (Iversen, 2004). Besides attitude, risk perception is also related to behaviours. According to Lund and Rundmo (2009), higher levels of risk perception among road users leads to more obedience of traffic rules. Road users get used to risks when they were exposed to risks several times, resulting in a lower level of risk perception. Thus, drivers in developing countries where there are a high frequencies of traffic accidents have a lower level of risk perception, compared to developed countries (Lund & Rundmo, 2009). Young drivers who exaggerate their driving skills frequently underestimate the likelihood of traffic crashes (Deery, 1999). Children need more time to react hazards on roads, compared to adults, since they face difficulties in understanding necessary information (Vansteenkiste et al., 2016).

Children start the crucial process of learning via imitation and observation (Bandura, 1965, 1972). During their childhood, parents and caregivers may serve as good role models for their children when it comes to safety skills on roads (Elliott, 1999). Children may be taught safe pedestrian skills by parents, teachers, or other adults (Barton & Huston, 2012; Barton & Schwebel, 2007). Children closely observe their parents' safety precautions (Ehrlich et al., 2001). Children are made aware of parental safety practices that deviate from what they are taught (Morrongiello et al., 2008).

Studies have been found effects of attitude, risk perception, age, and observed misbehaviours on behaviour. Dinh et al. (2020) found that safer pedestrian behavior is associated with more positive views about traffic safety and greater levels of perception of traffic risk. According to Alonso et al. (2018), Road safety behavior is influenced by age, observable misbehaviours, attitudes toward road safety, and risk perception (Alonso et al., 2018). Ulleberg and Rundmo (2003) revealed that age and gender have an impact on attitudes and dangerous behavior when it comes to concerns with driving safety, such as speeding and disobeying the law.

2. Research Objectives and Hypotheses

Although factors affecting school-going children have been found (Alonso et al., 2017; Alonso et al., 2018; Trifunović et al., 2017; Zeedyk et al., 2001), little was known about factors influencing traffic safety behaviour of school-going children from different

transport modes in India. Thus, the present study's objectives were (1) to identify and evaluate the important factors which affect the road safety behaviors among school-going children per transport mode; (2) to establish and describe the relationship of these variables on road safety behaviour per transport mode.

Based on the present study's objectives, hypotheses were first, these factors including socio-demographic variables, knowledge about traffic signs and signals, attitude towards road safety, observed road misbehaviours from parents or elders, and risk perception are important factors affecting school-going children's road safety behaviour; and second, these factors have a significant associations to school-going children' s self-reported risky behaviours.

3. Research Methodology

3.1 Questionnaire

A questionnaire consisting of six sections was used for modelling. The first question enquired about the respondent's age. Using a 3-item scale, the second section evaluated the candidates' understanding of traffic laws and their aptitude for recognizing traffic signals. In the third section, participants' attitudes toward road safety were evaluated using a 4-item scale that included a series of statements about safe and risky attitudes. The forth section concentrated to evaluate students' risk perception by using a 3-item scale which presented potentially risky road situations with pictures (for example, running to catch a moving bus). In the fifth section, students were asked to rate how frequently their parents or other adults around them engaged in dangerous driving behaviours using a 4-item frequency scale (for example, how often do your parents not wear a helmet while driving a two wheeler?). The last section was composed of statements about self-reported risky behaviours, which consists of a 4-item questionnaire asking how frequently participants usually performed some risky behaviours (for example, put your head/hands out of a moving bus). Table 1 presents variables and their indicators for private/state bus, among other transport modes (walking, bike, two wheelers, car, rickshaw). These four variables (knowledge, attitude, risk perception, observed misbehaviour, risky behaviour) had internal reliability scores of .89, .85, .75, .74 and .76, respectively.

3.2 Participants, Data Collection, and Analysis

The data was collected from schools across India mainly from Kerala and Maharashtra of students who aged between 12 to 18 years old and studied from class 7^{th} to 12^{th}. A total of 1225 schoolchildren filled out questionnaires, 626 of them males (51%), and 599 of them girls (49%). Out of the total responses, 16% children used private/state bus, 16% children went to school by walking, 24% children used school bus, 14% children were dropped by two-wheeler, 8% children used bicycle, 13% children used auto rickshaw, and 9% children were dropped by car.

Before the study, the students' written informed consent was acquired. Face-to-face interviews and paper surveys were means of data collection in the present study. The collected data was entered into Google forms manually, and the entire data was extracted into Microsoft Excel for the ease of handling. Schoolchildren filled out questionnaires in front of their teachers; in certain situations, they were left to finish the forms on their own. If any student needed help answering a question, they were given assistance. In other cases, the investigators walked the kids through the process of explaining question by question while giving them time to respond to each one.

Using a structural equation modelling (SEM) approach with maximum likelihood estimations and the following significance parameters: $p<0.05$, $p<0.01$, and $p<0.001$, the influence of variables such as age, attitude, risk perception, and observed misbehaviours on self-reported risky road behaviours of students was examined. SPSS AMOS 21 (Statistical Package for Social Sciences) was the program utilized for the modelling.

Table 1. Variables and their indicators for transport modes

Variable		Transport mode							References
		Private state bus	Walking	School bus	Two wheeler	Bike	Auto-rickshaw	Car	
AT (Attitude)	AT1	Attitude towards hanging out from the door of an overcrowded bus	Attitude towards using cellphones, reading etc. while crossing road	Attitude towards standing in queue to get into bus	Attitude towards always wearing helmet while travelling	Attitude towards always wearing helmet while travelling	Over speeding of auto rickshaws can cause accidents	Attitude towards wearing seat belt	Riaz et al. (2019)
	AT2	Attitude towards putting hands/head out of moving bus	Attitude towards using zebra crossing to cross the road	Attitude towards getting down from a moving bus	Attitude towards properly buckling the helmet	Attitude towards properly buckling the helmet	Attitude towards putting out body parts out	Attitude towards plying music loudly inside car	
	AT3	Attitude towards it is danger to get down from the bus before it is completely stopped	Attitude towards using sidewalks	Attitude towards putting hand/head out of a moving vehicle	Attitude towards travelling with more than two people	Attitude towards travelling with more than two people	There is no harm in carrying a greater number of passengers as long as the driver is able to drive	Attitude towards getting down from car after ensuring no vehicle approaching from sides	
	AT4	Attitude towards always following queue while getting into bus	Attitude towards crossing the road by running	Attitude towards crossing the road from behind the bus	Attitude towards avoiding unnecessary movements while travelling	Attitude towards avoiding unnecessary movements while travelling	Getting down from the auto rickshaw before it is completely stopped	Attitude towards putting head/hand	
PE (Perception)	PE1	Hanging out of the door in a moving bus	Crossing the road by running	Putting body parts out of moving vehicle	Carrying more than two passengers	Carrying more than two passengers	Overloading auto rickshaw with children	Putting body parts out of moving car	Glendon et al. (2014)

	PE2	Running to catch the bus	Jumping over the guard rails	Overloading of bus	Opening umbrella on a moving two wheeler	Opening umbrella on a moving two-wheeler	Sitting in dangerous position	Opening doors without looking for any vehicles coming from sides	
	PE3	Trying to get down from a moving bus	Using mobile phones while crossing	Running to catch a moving bus	Hanging out dress near the wheel of bike	Hanging out dress near the wheel of bike	Putting body parts out of a moving auto rickshaw	Distracting the drivers while driving	
OM (Observed Misbehaviour)	OM1	Not wearing helmet	Not wearing helmet	Not wearing helmet	Not wearing helmet	Not wearing helmet	Not wearing helmet	Not wearing helmet	Alonso et al., (2018)
	OM2	Driving vehicle after consuming alcohol	Driving vehicle after consuming alcohol	Driving vehicle after consuming alcohol	Driving vehicle after consuming alcohol	Driving vehicle after consuming alcohol	Driving vehicle after consuming alcohol	Driving vehicle after consuming alcohol	
	OM3	No seat belt use	Not wearing seat belt	Not wearing seat belt	Not wearing seat belt	Not wearing seat belt	Not wearing seat belt	Not wearing seat belt	
	OM4	Phone use while driving	Using mobile phone while driving	Using mobile phone while driving	Using mobile phone while driving	Using mobile phone while driving	Using mobile phone while driving	Using mobile phone while driving	
RB (Risky Behaviour)	RB1	Putting hands/head out of moving bus	Doing activities that causes distraction	Putting hands/head out of moving bus	Not wearing helmet while travelling	Not wearing helmet while travelling	Put your head or hands out of moving auto rickshaw	Not wearing seatbelt	Dinh et al., (2020)
	RB2	Climb down from a moving bus	Not using zebra crossing when it is provided	Climbing down from a moving bus before it is completely stopped	Not buckling up the helmet strap properly	Not buckling up the helmet strap properly	Getting yourself seated in dangerous positions	Doing activities that can cause distractions to the driving person	
	RB3	Push and shove others when they are boarding the bus	Crossing roads at dangerous spots	Crossing road from behind the bus after getting down	Try to get down from the vehicle before it is completely stopped	Try to get down from the vehicle before it is completely stopped	Travel in auto rickshaw when it is overloaded	Putting your head or hands out of moving vehicle	

	RB4	Traveling hanging out from the door of moving bus	Crossing through gaps between vehicles stopped in traffic jams	Push/shove others when they are boarding for bus	Doing activities that can cause distractions to driver	Doing activities that can cause distractions to driver	Getting down from the auto rickshaw before it completely stops	Try to get out from the vehicle before it is completely stopped	
	AGE	Age of the student	Age of the student	Age of the student	Age of the student	Age of the student	Age of the student	Age of the student	
Knowledge	KWL-DGE	Knowledge about legal driving age, traffic signs and signals	Knowledge about legal driving age,traffic signs and signals	Knowledge about legal driving age,traffic signs and signals	Knowledge about legal driving age,traffic signs and signals	Knowledge about legal driving age, traffic signs and signals	Knowledge about legal driving age,traffic signs and signals	Knowledge about legal driving age,traffic signs and signals	Alonso et al., (2018)

4. Results

4.1 SEM of Private/state Bus Use

After eliminating 4 outliers, the parameters of the sample (n=192) were taken into account and the proposed structural model was altered to match the data. One item (AT3) was eliminated due to its less loading.

Age (β=0.31, p<0.001), observed road misbehaviours (β = 0.41, p< 0.001), and risky behaviors (dependent variable) are positively correlated, according to the standardized path coefficients in Table 1 and values adjacent to solid lines in Figure 1 of the model. Those who are older and who have witnessed more risky driving behaviours in their parents and elders also likely to exhibit more self-reported risky driving behaviours. On the other side, hazardous behavior was shown to be negatively correlated with knowledge of traffic (β = 0.25, p<0.0011), risk perception (β =0.33, p<0.001), and good attitudes toward road safety (β = 0.34, p<0.001). In other words, the lower the score for unsafe road behaviours reported by youngsters, the higher the scores in knowledge, risk perception, and favourable attitudes toward road safety (Appendix A). The goodness of fit metrics for the improved model were measured. The measured parameters are seen to be within the acceptable range (Appendix B).

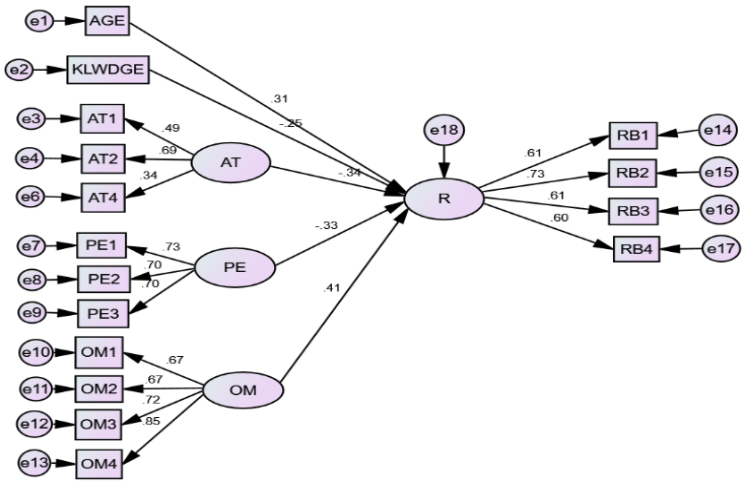

Figure 1 Revised SEM model for private/state bus

4.2 SEM of Walking

After eliminating 5 outliers, the proposed structural model was modified to suit the data while taking into account the characteristics of the 200-person sample. It was discovered that the indication "AT4" had less loading, thus it was removed and the model was updated. Figure 2 displays the updated and final

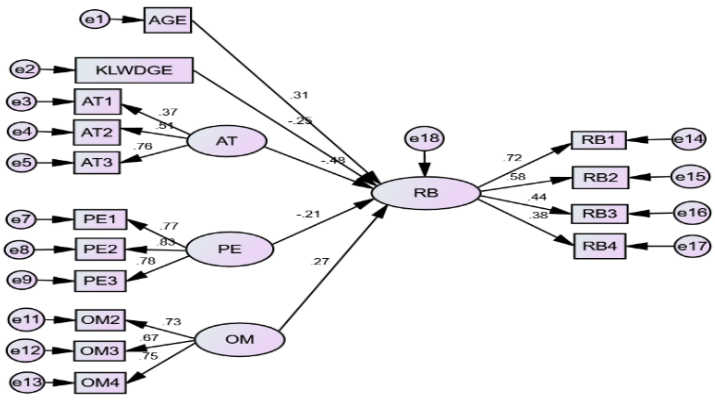

Figure 2 Revised SEM model for walking

structural equation model for the mode of walking.

The improved model's path coefficient and goodness of fit metrics are inside the acceptable range. Age (β=0.31, p<0.001), observed road misbehaviours (β=0.27, p<0.01), and risky behaviours on the road (dependent variable) are positively correlated, according to the standardized path coefficients and values close to solid lines of the model. In other words, those who are older and have seen more risky driving behaviors in their parents and elders also likely to exhibit more of these behaviors themselves. Contrarily, it was discovered that risky behaviors had negative correlations with traffic knowledge (β= -0.25, p<0.001), risk perception (β = −0.21, p<0.01), positive attitudes towards road safety (β = −0.48, p<0.001), and risky behaviours. This indicates less unsafe driving behavior is reported by students when knowledge, risk perception, and positive attitudes toward road safety are higher (Appendix A and B).

4.3 SEM of Two-wheeler Use

The proposed structural model was modified using the SPSS AMOS path analysis to match the data and take into account the characteristics of the n = 173 sample after 3 outliers were eliminated. The model is changed, and 'OM1' is removed as an indication. Figure 3 displays the updated and final structural equation model for two-wheelers.

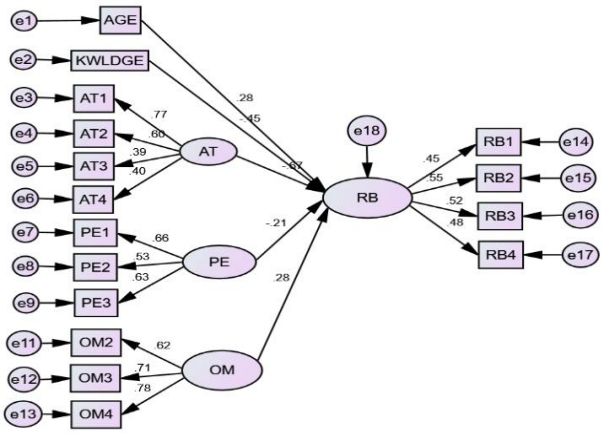

Figure 3 Revised SEM model for two wheeler

The improved model's path coefficient and goodness of fit metrics are inside the acceptable range. Age (β = 0.28, p<0.01), observed road misbehaviours (β = 0.28, p< 0.01), and risky behaviours on the road (dependent variable) are positively correlated, according to the standardized path coefficients and values next to solid lines of the model. To put it another way, those who are older and who have witnessed more risky driving behaviours in their parents and elders also likely to exhibit more self-reported risky driving behaviours. On the other hand, there were adverse correlations between risky behaviours and knowledge of traffic (β= -0.33, p<0.001), risk perception (β = −0.21, p<0.05), positive attitudes towards road safety (β = −0.67, p<0.001), and risky behaviours. In other words, the lower the score for unsafe road behaviours reported by students, the higher the scores in knowledge, risk perception, and favourable attitudes toward road safety (Appendix A and B).

4.4 SEM of Bicycle Use

The proposed structural model was modified using the SPSS AMOS path analysis to match the data and take into account the characteristics of the n = 100 sample after eliminating 5 outliers. The model is changed, and the item "PE3" is removed. Figure 4 depicts the updated and completed structural equation model for bicycles.

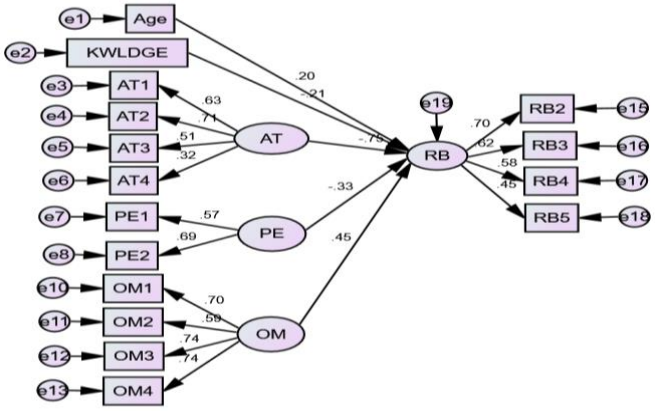

Figure 4 Revised SEM model for bike

The improved model's path coefficient and goodness of fit metrics are inside the acceptable range. Age (β = 0.20, p<0.05), observed road misbehaviours (β = 0.45, p< 0.001), and risky behaviours on the road are positively correlated, according to the standardized path coefficients and values next to solid lines of the model. To put it another way, those who are older and who have witnessed more risky driving behaviours in their parents and elders also likely to exhibit more self-reported risky driving behaviours. On the other hand, there were adverse correlations between risky behaviours and knowledge of traffic rules (β= −0.21, p<0.05), risk perception (β = −0.33, p<0.05), positive attitudes towards road safety (β = −0.75, p<0.001), and risky behaviours. The score for children's reported unsafe road behaviours decreases as knowledge, risk perception, and positive attitudes toward road safety increase (Appendix A and B).

4.5 SEM of Auto-rickshaw Use

The proposed structural model was modified using the SPSS AMOS path analysis to match the data and take into account the characteristics of the 156-person sample after 3 outliers were eliminated. The sign "AT3" is removed from the model once it was discovered to have less loading. Recursive modelling is used. Figure 5 displays the updated and completed structural equation model for an auto rickshaw.

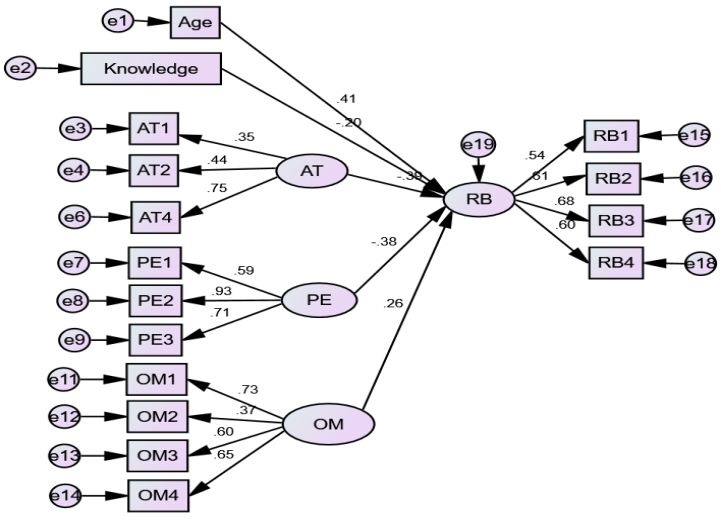

Figure 5 Revised SEM model for auto-rickshaw

The improved model's path coefficient estimate and goodness of fit metrics are within the acceptable range. The age (β=0.41, p<0.001), observed road misbehaviours (β=0.26, p<0.05), and risky behaviours (dependent variable) are positively correlated, according to the standardized path coefficients and values next to solid lines of the model. To put it another way, those who

are older and who have witnessed more risky driving behaviours in their parents and elders also likely to exhibit more self-reported risky driving behaviours. However, there were adverse correlations between hazardous behavior and knowledge of traffic (β= -0.20, p<0.05), risk perception (β = −0.38, p<0.001), positive attitudes towards road safety (β = −0.39, p<0.01), and risky behaviours. Less unsafe driving behavior is reported by youngsters when knowledge, risk perception, and positive attitudes toward road safety are higher (Appendix A and B).

4.6 SEM of Car Use

The proposed structural model was modified using the SPSS AMOS path analysis to match the data and take into account the characteristics of the 111-person sample after 6 outliers were eliminated. The model is updated and the sign "PE1" is removed. Figure 6 displays the updated and completed structural equation model for the automobile.

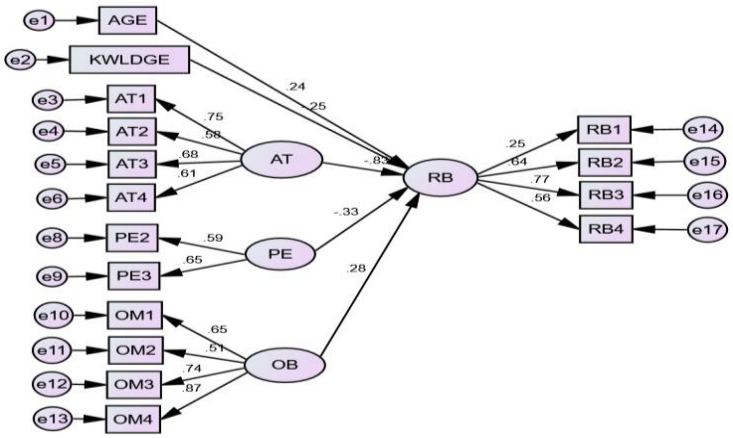

Figure 6 Revised SEM model for car

The improved model's path coefficient and goodness of fit metrics are inside the acceptable range. Age (β = 0.24, p<0.01), observed road misbehaviours (β = 0.28, p< 0.01), and risky behaviours (dependent variable) are positively correlated, according to the standardized path coefficients and values next to solid lines of the model. To put it another way, those who are older and who have witnessed more risky driving behaviours in their parents and elders also likely to exhibit more self-reported risky driving behaviours. On the other hand, there were adverse correlations between hazardous behavior and knowledge of traffic β= -0.25, p<0.01), risk perception (β = −0.33, p<0.05), positive attitudes towards road safety (β = −0.83, p<0.001), and risky behaviours.

The path coefficient and the goodness of fit measures for the revised model are within the permissible range. The standardized path coefficients and values next to solid lines of the model show positive associations between age (β = 0.24, p<0.01), observed road misbehaviours (β = 0.28, p< 0.01), and risky behaviours on the road (dependent variable). Put another way, individuals with greater age and observing more road-risk behaviours in their parents and elders also tend to present more self-reported road misbehaviours. On the other hand, negative relationships were found between knowledge of traffic (β= -0.25, p<0.01), risk perception (β = −0.33, p<0.05), positive attitudes towards road safety (β = −0.83, p<0.001), and risky behaviours. Less unsafe driving behavior is reported by students when knowledge, risk perception, and positive attitudes toward road safety are higher (Appendix A and B).

5. Discussions

The purpose of the current work is to assess the traffic knowledge, risk perception, attitude, and stated traffic behavior of schoolchildren in India and to investigate how these

aspects impact children's behavior. A questionnaire was prepared and after conducting pilot survey, the data was collected from 1225 students studying from class 7^{th} to 12^{th} across India.

All seven types of transport modes underwent structural equation modelling, and models with good fit and significant routes were developed. The findings suggested that school-age children's risky road behavior, independent of the method of transportation, was impacted by age, understanding of traffic signs and signals, attitude toward road safety, perception of danger, and observed road misbehaviours.

The findings of children's ages indicated that age is one of the elements impacting school-aged children's road safety behaviours. Studies have shown that age is often related with a falling trend in the performance of dangerous behaviours when groups of teenage and adult road users are analysed together (Alonso Plá et al., 2016; Şimşekoğlu, 2015; Taubman–Ben-Ari, 2015). However, the adolescents represent the oldest age group in the current study. They are therefore more likely to engage in risky behaviours (Alonso et al., 2018; Papadimitriou et al., 2013).

Another important aspect impacting driving behavior is familiarity with traffic laws and circumstances, which is also one of the foundations of road safety education (Assailly, 2017; Dragutinovic & Twisk, 2006). Students who have knowledge of traffic rules could apply to actual behaviours in order to prevent themselves from accidents on roads (Assailly, 2017). The findings indicated that individuals who shown a lack of familiarity with traffic signals, signs, and norms tended to incur greater risks when driving (Alonso et al., 2018). However, several studies have shown that youngsters who are more aware of road safety do not necessarily behave better in actual traffic situations (Zeedyk et al., 2001).

Şimşekoğlu (2015) indicated that attitudes are major determinants of pedestrian behaviour. The association between safe behavior and attitudes about worries about road safety, particularly among young drivers, has been the subject of several studies (Iversen, 2004; Ulleberg & Rundmo, 2003). Alonso Plá et al. (2016) implied that the performance of risky behaviours is inversely associated to positive attitudes about road safety. From the present study, it is found that children showing more positive attitude towards traffic safety tend to show less risky behaviours (Alonso et al., 2018). This finding is consistent with the Theory of Planned Behaviour (TPB) (Ajzen, 2011), which suggests that positive attitudes towards a behavior are more likely to lead to the intention to engage in that behavior.

The findings on the impact of risk perception revealed a negative relationship between risk perception and hazardous behavior (Alonso et al., 2018). Studies have found that participants' self-reported scores for risky driving behaviours were significantly higher on average for those with lower risk perception (Alonso Plá et al., 2016; Useche et al., 2018). This finding supports the TPB's notion that perceived behavioral control, which includes risk perception, influences behavioral intentions (Ajzen, 2011).

Besides risk perception and attitude towards road safety, the present study found that road misbehaviours observed by children influenced their hazardous behaviours on roads (Alonso et al., 2018). Mehdizadeh et al. (2017) suggested that the behavior of parents and older people had an impact on children's road safety. The results align with the TPB's concept of subjective norms, which refers to the perceived social pressure to conform to certain behaviors. In this case, children may imitate the road behaviors of their parents and other influential individuals (Ajzen, 2011). Previous research has found that important stakeholders like parents and teachers must be involved in addressing the road

behaviors of children (Green et al., 2008; Ojo, 2018). The risky behaviours of parents are commonly imitated by their kids (Taubman-Ben-Ari et al., 2014). Drivers who are cautious are more likely to have cautious children, highlighting the relevance of good attitudes in safety behaviours (Sam, 2015).

In general, many factors influencing school-age children have been found in previous study, but little is known about how these factors affect road safety behavior in the Indian environment. The study was to determine the association between these variables and road safety behavior by identifying and assessing critical factors influencing road safety behaviors among school students using various means of transportation. The results demonstrated how age influences school-age children's road safety habits. An higher tendency to take risks was linked to unfamiliarity with signs, traffic signals, and social norms. The Theory of Planned conduct was found to be supported by the finding that better attitudes about road safety were linked to decreased hazardous behaviour. Hazardous behaviour and risk perception have a negative relationship, suggesting that behavioral intentions are influenced by perceived behavioral control. Furthermore, children's perceptions of unsafe behaviour on the road shaped their own risky perceptions, supporting the idea of subjective norms. These findings have implications for treatments and policy actions to promote safer road behaviors in this demographic and further our understanding of the determinants impacting traffic safety behaviors among school-age children in India.

6. Conclusion

Seven separate modes each have their own structural equation model. These are the means of transportation that the students use to commute to school. For each mode different questions related to knowledge, attitude, risk perception, observed misbehaviours from parents or elders and performed risky behaviours were asked to children depending on their mode of transport. It was observed that risky behavior tend to decrease when positive attitude, risk perception, and traffic knowledge rise among students using all seven modes. With increase in age and observed misbehaviours from parents and elders the performance of risky behaviour is found to increase. This leads to the conclusion that improving the knowledge, attitude and risk perception is essential in bringing down the risky behaviours of children on road.

Limitations and recommendations of the present study

The limitations of the present study as it is neglected to account for gender- and age-based factors. This impacts the results of the models. Furthermore, the present study only looked at the Indian context. As a result, the conclusions may not be reflective of circumstances outside of India.

Future studies should include factors based on age and gender in their models. By doing this, researchers investigate more about differences and inequalities between various student groups and gender types, which creates more individualized educational interventions. Furthermore, the study should be focused on the local and regional factors that might affect educational results. By doing this, a variety of contexts may be investigated, leading to a comprehension of the variables influencing student behaviours.

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Appendix A - Path coefficient estimate for final model of transport modes

Private/state bus						Walking						School bus					
Path			Estimate	S.E.	C.R.	Path			Estimate	S.E.	C.R.	Path		Estimate	Estimate	S.E.	C.R.
RB	<--	AT	-0.267	0.092	-2.911	RB	<--	AT	-0.651	0.196	-3.316	RB	<---	AT	-0.6	0.161	-3.718
RB	<--	PE	-0.232	0.063	-3.669	RB	<--	PE	-0.251	0.093	-2.69	RB	<---	PE	-0.319	0.067	-4.787
RB	<--	OM	0.205	0.046	4.431	RB	<--	OM	0.216	0.078	2.758	RB	<---	OM	0.193	0.07	2.766
RB	<--	KWLDGE	-0.53	0.155	-3.41	RB	<--	KLWDGE	-1.08	0.333	-3.24	RB	<---	KLWDGE	-0.6	0.133	-4.512
RB	<--	AGE	0.081	0.02	4.116	RB	<--	AGE	0.14	0.037	3.829	RB	<---	AGE	0.047	0.014	3.273
AT1	<--	AT	1	-	-	AT1	<--	AT	1	-	-	RB1	<---	RB	1	-	-
AT2	<--	AT	1.509	0.484	3.117	AT2	<--	AT	0.728	0.199	3.65	RB2	<---	RB	1.31	0.229	5.728
AT4	<--	AT	0.611	0.203	3.003	AT3	<--	AT	1.311	0.377	3.472	RB4	<---	RB	1.771	0.297	5.962
PE1	<--	PE	1	-	-	PE1	<--	PE	1	-	-	AT3	<---	AT	1.122	0.28	4.014
PE2	<--	PE	1.032	0.143	7.218	PE2	<--	PE	0.993	0.095	10.435	AT2	<---	AT	1.081	0.255	4.241
PE3	<--	PE	1.081	0.149	7.228	PE3	<--	PE	0.96	0.094	10.233	AT1	<---	AT	1	-	-
OM1	<--	OM	1	-	-	OM1	<--	OM	1	-	-	PE3	<---	PE	1.065	0.18	5.909
OM2	<--	OM	0.769	0.099	7.779	OM2	<--	OM	0.724	0.095	7.627	OM4	<---	OM	2.139	0.423	5.059
OM3	<--	OM	1.02	0.124	8.233	OM3	<--	OM	1.176	0.139	8.457	OM3	<---	OM	1.806	0.357	5.065
OM4	<--	OM	1.261	0.141	8.968	RB1	<--	RB	1	-	-	OM2	<---	OM	1.223	0.261	4.687

RB1	<--	RB	1	-	-	RB2	<--	RB	0.901	0.15	6.005	PE1	<---	PE	1	-	-
RB2	<--	RB	1.325	0.19	6.985	RB3	<--	RB	0.696	0.139	5.019	RB3	<---	RB	1.183	0.238	4.961
RB3	<--	RB	1.218	0.193	6.326	RB4	<--	RB	0.563	0.133	4.217	OM1	<---	OM	1	-	-
RB4	<--	RB	1.375	0.22	6.256	OM 4	<--	OM	1.055	0.128	8.229						

Two wheeler						**Cycling**						**Auto rich-shaw**					
Path			Estimate	S.E.	C.R.	Path			Estimate	S.E.	C.R.	Path			Estimate	S.E.	C.R.
RB	<--	KWLDGE	-1.009	0.235	-4.302	RB	<--	KWLDGE	-0.836	0.357	-2.344	RB	<---	AT	-0.704	0.27	-2.611
RB	<--	AGE	0.085	0.027	3.169	RB	<--	AGE	0.118	0.051	2.305	RB	<---	PE	-0.409	0.104	-3.941
RB	<--	AT	-0.513	0.121	-4.239	RB	<--	AT	-0.999	0.225	-4.445	RB	<---	OM	0.12	0.055	2.201
RB	<--	PE	-0.188	0.095	-1.988	RB	<--	PE	-0.463	0.199	-2.33	RB	<---	KWLDGE	0.484	0.206	2.353
RB	<--	OM	0.216	0.081	2.655	RB	<--	OM	0.358	0.094	3.83	RB	<---	AGE	0.094	0.021	4.385
AT1	<--	AT	1			AT1	<--	AT	1	-	-	AT2	<---	AT	1.56	0.557	2.804
AT2	<--	AT	0.795	0.137	5.802	AT3	<--	AT	0.921	0.235	3.921	AT4	<---	AT	2.146	0.782	2.745
AT4	<--	AT	0.719	0.167	4.296	PE1	<--	PE	1	-	-	PE1	<---	PE	1	-	-
PE1	<--	PE	1			PE2	<--	PE	1.186	0.57	2.081	PE2	<---	PE	1.625	0.239	6.796
PE2	<--	PE	0.891	0.206	4.316	OM 1	<--	OM	1	-	-	PE3	<---	PE	1.34	0.195	6.881

PE3	<--	PE	0.954	0.221	4.319	OM 3	<--	OM	0.921	0.153	6.029	OM1	<---	OM	1	-	-
OM2	<--	OM	1			OM 4	<--	OM	1.042	0.173	6.016	OM2	<---	OM	0.429	0.117	3.667
OM3	<--	OM	1.247	0.193	6.451	RB2	<--	RB	1	-	-	OM3	<---	OM	0.769	0.144	5.353
OM4	<--	OM	1.59	0.25	6.37	RB3	<--	RB	0.777	0.147	5.274	OM4	<---	OM	0.99	0.18	5.494
RB1	<--	RB	1			RB4	<--	RB	0.947	0.19	4.985	RB1	<---	RB	1	-	-
RB2	<--	RB	1.121	0.248	4.526	RB5	<--	RB	0.613	0.155	3.957	RB2	<---	RB	1.084	0.204	5.314
RB3	<--	RB	1.118	0.252	4.435	AT2	<--	AT	1.22	0.251	4.862	RB3	<---	RB	1.493	0.263	5.675
RB4	<--	RB	0.987	0.235	4.201	AT4	<--	AT	0.543	0.207	2.631	RB4	<---	RB	1.233	0.232	5.317
AT3	<--	AT	0.736	0.177	4.162	OM 2	<--	OM	0.793	0.157	5.046	AT1	<---	AT	1	-	-

Car					
Path			Estimate	S.E.	C.R.
RB	<--	AT	-0.633	0.107	-5.899
RB	<--	PE	-0.327	0.129	-2.53
RB	<--	OM	0.348	0.123	2.817
RB	<--	KWLDGE	-0.528	0.167	-3.153

RB	<--	AGE	0.09	0.029	3.122
PE2	<--	PE	1	-	-
PE3	<--	PE	1.06	0.453	2.34
OM2	<--	OM	1	-	-
OM3	<--	OM	2.058	0.417	4.931
OM4	<--	OM	2.175	0.428	5.083
RB2	<--	RB	1	-	-
RB4	<--	RB	0.745	0.149	4.998
OM1	<--	OM	1.789	0.387	4.623
AT1	<--	AT	1	-	-
AT3	<--	AT	0.874	0.136	6.444
AT4	<--	AT	0.918	0.157	5.857
RB3	<--	RB	1.148	0.178	6.466
RB1	<--	RB	0.488	0.203	2.408
AT2	<--	AT	0.7	0.126	5.547

Appendix B – Goodness of fit and indices for private bus

Priate/state bus					Walking					School bus				
Goodness of fit and indices	**Parameters**	**Permissible range**	**Hypothetical model**	**Revised model**	**Goodness of fit and indices**	**Parameters**	**Permissible range**	**Hypothetical model**	**Revised model**	**Goodness of fit and indices**	**Parameters**	**Permissible range**	**Hypothetical model**	**Revised model**
Goodness of fit index	Chi square	As low as possible	242.52	209.169	Goodness of fit index	Chi square	As low as possible	262.313	197.97	Goodness of fit index	Chi square	As low as possible	306.338	216.35
	DOF	As high as possible	116	101		DOF	As high as possible	116	87		DOF	As high as possible	116	87
	Normed chi square (chi square /DOF)	Between 2 and 5	2.09	2.071		Normed chi square (chi square /DOF)	Between 2 and 5	2.261	2.276		Normed chi square (chi square/DOF)	Between 2 and 5	2.641	2.487
	P-value	>0.05 or 0.01	0	0		P-value	>0.05 or 0.01	0	0		P-value	>0.05 or 0.01	0	0
Absolute fit indices	GFI	0 to 1	0.873	0.876	Absolute fit indices	GFI	0 to 1	0.867	0.884	Absolute fit indices	GFI	0 to 1	0.889	0.909
	Adjusted GFI	>0.80	0.833	0.831		Adjusted GFI	>0.80	0.824	0.84		Adjusted GFI	>0.80	0.854	0.875
	RMSEA	<0.08	0.071	0.065		RMSEA	<0.08	0.08	0.08		RMSEA	<0.08	0.075	0.071
Incremental fit indices	NFI	>0.90 or 0.95	0.764	0.789	Incremental fit indices	NFI	>0.90 or 0.95	0.732	0.761	Incremental fit indices	NFI	>0.90 or 0.95	0.681	0.788
	TLI	>0.90 or 0.95	0.843	0.89		TLI	>0.90 or 0.95	0.797	0.815		TLI	>0.90 or 0.95	0.729	0.7
	CFI	>0.90 or 0.95	0.866	0.869		CFI	>0.90 or 0.95	0.826	0.846		CFI	>0.90 or 0.95	0.769	0.824

	RFI	>0.90 or 0.95	0.723	0.736		RFI	>0.90 or 0.95	0.686	0.711		RFI	>0.90 or 0.95	0.626	0.69
	IFI	>0.90 or 0.96	0.869	0.871		IFI	>0.90 or 0.96	0.83	0.85		IFI	>0.90 or 0.96	0.774	0.829
Parsimony fit indices	PNFI	>0.50	0.652	0.655	Parsimony fit indices	PNFI	>0.50	0.624	0.63	Parsimony fit indices	PNFI	>0.50	0.581	0.616
	PGFI	>0.50	0.632	0.649		PGFI	>0.50	0.657	0.641		PGFI	>0.50	0.674	0.659

Two wheeler					**Bike**					**Auto-rickshaw**				
Goodness of fit and indices	**Parameters**	**Permissible range**	**Hypothetical model**	**Revised model**	**Goodness of fit and indices**	**Parameters**	**Permissible range**	**Hypothetical model**	**Revised model**	**Goodness of fit and indices**	**Parameters**	**Permissible range**	**Hypothetical model**	**Revised model**
Goodness of fit index	Chi square	As low as possible	259.662	182.73	Goodness of fit index	Chi square	As low as possible	166.004	140.816	Goodness of fit index	Chi square	As low as possible	272.061	235.171
	DOF	As high as possible	116	101		DOF	As high as possible	116	101		DOF	As high as possible	116	101
	Normed chi square (chi square /DOF)	Between 2 and 5	2.238	2.159		Normed chi square (chi square /DOF)	Between 2 and 5	1.431	1.394		Normed chi square (chi square/DOF)	Between 2 and 5	2.344	2.328
	P-value	>0.05 or 0.01	0	0		P-value	>0.05 or 0.01	0	0		P-value	>0.05 or 0.01	0	0
Absolute fit indices	GFI	0 to 1	0.851	0.867	Absolute fit indices	GFI	0 to 1	0.837	0.853	Absolute fit indices	GFI	0 to 1	0.835	0.844
	Adjusted GFI	>0.80	0.804	0.821		Adjusted GFI	>0.80	0.786	0.802		Adjusted GFI	>0.80	0.782	0.79
	RMSEA	<0.08	0.08	0.071		RMSEA	<0.08	0.07	0.07		RMSEA	<0.08	0.084	0.082
	NFI	>0.90 or 0.95	0.668	0.788		NFI	>0.90 or 0.95	0.683	0.712	Incremental fit indices	NFI	>0.90 or 0.95	0.657	0.684

Incremental fit indices	TLI	>0.90 or 0.95	0.739	0.7	Incremental fit indices	TLI	>0.90 or 0.95	0.849	0.872		TLI	>0.90 or 0.95	0.723	0.745
	CFI	>0.90 or 0.95	0.777	0.824		CFI	>0.90 or 0.95	0.871	0.892		CFI	>0.90 or 0.95	0.764	0.785
	RFI	>0.90 or 0.95	0.61	0.69		RFI	>0.90 or 0.95	0.629	0.658		RFI	>0.90 or 0.95	0.598	0.625
	IFI	>0.90 or 0.96	0.784	0.829		IFI	>0.90 or 0.96	0.877	0.897		IFI	>0.90 or 0.96	0.771	0.792
Parsimony fit indices	PNFI	>0.50	0.57	0.579	Parsimony fit indices	PNFI	>0.50	0.583	0.599	Parsimony fit indices	PNFI	>0.50	0.56	0.576
	PGFI	>0.50	0.645	0.644		PGFI	>0.50	0.632	0.633		PGFI	>0.50	0.633	0.627

Car				
Goodness of fit and indices	**Parameters**	**Permissible range**	**Hypothetical model**	**Revised model**
Goodness of fit index	Chi square	As low as possible	294.64	258.75
	DOF	As high as possible	116	115
	Normed chi square (chi square /DOF)	Between 2 and 5	2.546	2.25
	P-value	>0.05 or 0.01	0	0
Absolute fit indices	GFI	0 to 1	0.744	0.855
	Adjusted GFI	>0.80	0.768	0.833

	RMSEA	<0.08	0.085	0.083
Incremental fit indices	NFI	>0.90 or 0.95	0.656	0.713
	TLI	>0.90 or 0.95	0.698	0.777
	CFI	>0.90 or 0.95	0.688	0.798
	RFI	>0.90 or 0.95	0.638	0.644
	IFI	>0.90 or 0.96	0.671	0.801
Parsimony fit indices	PNFI	>0.50	0.513	0.523
	PGFI	>0.50	0.52	0.523