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Thesis title: Factors influencing the parental decision of their children's commuting mode to and from school in Lima (Peru).

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Summary

The rise in private motorized commuting trips to school have negative consequences on children's health and their attitudes towards sustainable mobility, and adverse effects on the environment and urban congestion, implying decreased active modes of commuting and decreasing reliance on public transport. In Peru, specifically in Lima, children's trips to school could be a considerable contributor to traffic congestion at peak hours (Tom Tom, 2022) and therefore impact urban planning and sustainable mobility.

The main objective of the research was to identify the factors that influence parent's decision on commuting mode to school in the city of Lima (Peru). By controlling variables as distance to school and type of school (public or private), other factors like parent's safety perceptions on mobility may take a relevant role in this decision.

This research proposes to apply a methodology based a quantitative approach considering that the data required to achieve the objective of the research was either non-existent or insufficient, therefore the research strategy selected was a survey. To intend achieving data triangulation, it was employed mixed-methods of research by integrating quantitative and qualitative instruments. The quantitative instrument selected was a questionnaire and the qualitative ones were focus groups with survey respondents and semi-structured interviews with practitioners of the city of Lima specialized in urban mobility and urban form.

The research findings suggests that mid-high income groups' perceptions of traffic safety have a moderate effect on their children's school travel mode choice. Higher perceptions of traffic safety, which means perceptions of a safer traffic environment on the journey to school, make them less likely to select private motorized modes and more likely to select active modes. In low-income groups, traffic safety perceptions were not found as drivers for deciding on commuting mode to school. Perceived social safety was not found relevant to predict the selection of commuting modes to school in in neither of the two types of schools. Moreover, for this study income level have been found a relevant factor in the decision of the commuting mode to school.

Further research can propose income level a relevant factor for predicting the commuting mode to school for context such as Lima. The research also raises the question of policy in shaping urban development and the availability of education facilities across lima.

Keywords

School commuting, safety perceptions, modal choice, traffic safety, social safety.

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Foreword

Children are users who are poorly served by urban transportation in cities who, on their way to school, face safety threats derived from traffic, air pollution, and crime situations. Under this situation is understandable that parents often prevent them from walking or cycling on the street. Nevertheless, preventing children of walking and experiencing the environment in the years in which their personality is built has a great personal cost, impairing the development of calm, responsible, and conscientious persons (Tonucci, 2009).

This research seeks to bring to light to the transportation and mobility are for a better understanding of children's mobility to school and the importance of taking into consideration the parents' safety perceptions since they are the ones who select the transport mode for their children. In this manner, improved sustainable mobility initiatives can be implemented and be beneficial to children mobility and development.

Abbreviations

IHS	Institute for Housing and Urban Development Studies
INEI	Instituto Nacional de Estadística e Informática (National Institute of Statistics and Informatics)
ITDP	Institute for Transportation and Development Policy
MINEDU	Ministerio de Educación del Perú (Ministry of Education of Peru)
MTC	Ministerio de Transportes y Comunicaciones del Perú (Ministry of Transport and Communications of Peru)

Table of Contents

Summary.....	ii
Keywords	ii
Acknowledgements	iii
Foreword.....	iv
Abbreviations	iv
List of Figures.....	vii
List of Graphs.....	vii
List of Tables	vii
Chapter 1: Problem statement, research objective & research questions.....	9
1.1 Introduction	9
1.2 Background and problem statement	9
1.1.1 Research Objectives	10
1.1.2 Main research question and research sub-questions.....	10
1.3 Academic and practical relevance of the research topic.....	11
Chapter 2: Literature review & conceptual framework	12
2.1 State of the art: theories and concepts of the study.....	12
2.1.1 Sustainable mobility and school commuting.....	13
2.1.1.1 Sustainable mobility	13
2.1.1.2 Children in sustainable mobility	13
2.1.1.3 School commuting.....	14
2.1.2 Overview of the perception and safety concepts	14
2.1.2.1 Traffic safety perception from the perspective of parents	15
2.1.2.2 Social safety perception from the perspective of parents	15
2.1.2.3 Urban form	15
2.1.2.4 Past experiences	16
2.1.3 Socioeconomic environment.....	16
2.1.4 Related studies in Lima, Peru.....	17
2.2 Conceptual framework	17
Chapter 3: Research design & methodology	19
3.1 Operationalization	19
3.2 Research design	20
3.2.1 Methodology	20
3.2.2 Delimitation of the target group	21
3.3 Data collection methods	21
3.3.1 Survey - Questionnaires	21
3.3.2 Focus groups	22
3.3.3 Semi-structured interviews.....	22
3.3.4 Secondary data	22
3.4 Sampling and selection	22
3.4.1 Survey administration	23
3.5 Reliability and validity	24
3.6 Data analysis methods	25
3.6.1 Quantitative analysis	25
3.6.2 Qualitative analysis	26
3.7 Expected challenges and limitations.....	27
Chapter 4: Results, analysis and discussion	28
4.1 Socioeconomic profile of survey respondents.....	28

4.2 Influencing factors on parental perceptions of social and traffic safety	29
4.2.1 Urban form	30
4.2.1.1 Distance	30
4.2.1.2 Street profile to school	32
4.2.1.3 Past experiences	33
4.2.1.4 Cronbach's reliability test	33
4.3 Socioeconomic characteristics and commuting modes to school	34
4.3.1 Commuting modes to school	34
4.3.2 Commuting mode to school by sociodemographic profile	35
4.3.3 Commuting mode to school by socioeconomic profile	35
4.3.4 Attitudes towards sustainable mobility in mode choice	36
4.4 Perception on traffic and social safety and their influence on commuting modes to school decision	37
4.4.1 Exploring influences of perceived level of traffic safety on commuting mode to school	37
4.4.2 Exploring influences of perceived level of social safety on commuting mode to school	39
4.5 Interpretation of results	40
Chapter 5: Conclusions	42
5.2 Answer to the research questions	42
5.3 Societal and scientific contribution of this study	43
5.3 Practical implications of this study	43
5.2 Practical limitations and suggestions for further research	44
Bibliography	45
Appendix 1: Research instruments	52
Appendix 2: Data coding	69
Appendix 3: Contingency tables	71
Appendix 4: Correlation and chi-square outputs	73
Appendix 5: IHS copyright form	75

List of Figures

Figure 1: Location of the district of Breña and La Victoria respectively, Lima.....	23
Figure 2: Process of quantitative analysis.....	25
Figure 3: Process of qualitative analysis	26

List of Graphs

Graph 1: McMillan's Framework	18
Graph 2: Conceptual Framework of this study.....	18
Graph 3: Socioeconomic profile of respondents	28
Graph 4: Sociodemographic profile of children (Information provided by parents).....	29
Graph 5: Distance to school	30
Graph 6 and Graph 7: School commuting mode to a from school by type of school	34
Graph 8: Travel mode choice by type of school	35

List of Tables

Table 1: Definition of concepts	19
Table 2: Operationalization table	19
Table 3: Sample size calculation	23
Table 4: Number of responses.....	24
Table 5: Rules of thumb on the Cronbach's Alpha.....	24
Table 6: Interpretation of correlation values.....	25
Table 7: Perceived level of traffic safety by distance to school.....	30
Table 8: Correlations and p-value output between distance to school and perceived level of traffic safety.....	31
Table 9: Perceived level of social safety by distance to school.....	31
Table 10: Correlations and p-value output between distance to school and perceived level of social safety.....	31
Table 11: Correlations and p-value output between perceived adequacy of urban form and perceived level of traffic safety	32
Table 12: Correlations and p-value output between perceived adequacy of urban form and perceived level of social safety	32
Table 13: Correlations and p-value output between past traffic crash experience and perceived level of traffic safety	33
Table 14: Correlations and p-value output between past traffic crash experience and perceived level of social safety.....	33
Table 15: Sociodemographic characteristics by type of school and children's travel mode to school	35
Table 16: Household socioeconomic characteristics by type of school and children's travel mode to school	36
Table 17: Attitudes towards sustainable mobility by type of school and children's travel mode to school for distances from home within 3km	36
Table 18: Correlations and p-value output between perceived adequacy of urban form and perceived level of social safety	37
Table 19 : Perceived level of Traffic Safety by type of school and children's travel mode to school	38
Table 20: Correlations and p-value (two-tailed) output between perceived level of road safety and commuting mode to school.....	38
Table 21 : Perceived level of Social Safety by type of school and children's travel mode to school	40

Table 22: Variables used for data analysis	69
Table 23: Group of variables for the analysis.....	69
Table 24: Rating scales	70
Table 25: Sociodemographic characteristics by type of school and children’s travel mode to school	71
Table 26 : Household socioeconomic characteristics by type of school and children’s travel mode to school	72
Table 27: Correlation and Chi-square test (two-tailed) between attitudes towards sustainable mobility and Commuting modes to school.....	73
Table 28: Correlation outputs between socioeconomic variables	73
Table 29: Correlation and Chi-square test (two-tailed) between Domains and Commuting modes to school	73
Table 30: Correlation and Chi-square test (two-tailed) between Domains and Commuting modes for distances to school within 3km	74
Table 31: Correlation and Chi-square test (two-tailed-) between Domains and Commuting modes to school for perceived distance to school as “walkable”	74
Table 32: Correlation and Chi-square test (two-tailed-) between Domains and Commuting modes to school by household monthly income	74

Chapter 1: Problem statement, research objective & research questions

1.1 Introduction

There is a growing interest in the study of cities and their transportation among researchers and practitioners due to global challenges such as rapid urbanization. This is reflected on the Sustainable Development Goals which states in its target 11.2 to provide cities with safe, affordable, accessible, and sustainable transport systems with special attention to children and other vulnerable groups by 2030 (United Nations, 2015).

For the most part, cities and urban transport systems around the world are not prepared to accommodate children's mobility. A habitual trip that children make is to school and while in the last decades the commuting modes to school by walking or cycling have decreased, trips made by car have increased (Wen et al., 2008; Faulkner et al., 2010). Children's health, development of autonomy, and socialization skills are affected by the decrease of walking and cycling (Lang, Collins, and Kearns, 2011). Moreover, the development of certain lifestyle habits in children can cause them to be maintained or reinforced as adults. Motta Queiroz, Celeste, and Moura (2020), based on Morris et al. (2001) and Davison et al. (2007), argue that a child who is driven everywhere is likely to grow up and prefer the vehicle over other forms of transportation and repeat the cycle with their children.

Investigations motivated by the shift from non-motorized to motorized modes for school commuting around the world have commonly studied factors such as urban form (Mittra and Buliung, 2012, Bradshaw, 2001) and sociodemographic characteristics to explain children's travel patterns. However, limited studies have included the impact of parents' perceptions in defining their children's mode to school.

Until a certain age, parents or caregivers decide on the commuting mode to school for children (McMillan, 2005), and while distance is a determinant barrier for parents to active commuting to school (Mittra 2013), recent studies show that a walkable distance from home to school does not deter parents from driving their children (Westman, Friman, and Olsson, 2017). In that sense, parents' perceptions may have a stronger effect than urban form on the decision on commuting mode to school (McMillan, 2005), however, there is limited evidence of the role of the parental perception on school travel patterns decisions. Traffic safety perceptions are significant to the choice of car for school commuting in the Scandinavian context (Westman, Friman, and Olsson, 2017), however, in developing countries context, personal safety perceptions may have a more important role than in the Nordic countries where this is rather uncommon (Shutt et al., 2007).

1.2 Background and problem statement

Lima concentrates the highest population in Peru - 31% (Instituto Nacional de Estadística e Informática, 2021) and represents the third part of the national school enrolment (MINEDU, 2021). In the metropolitan area of Lima¹ about 24.5 million trips are made

¹ The metropolitan area of Lima is composed of the province of Lima and the constitutional province of Callao, which form a single urban area (only delimited by administrative boundaries) and share millions of daily trips among each other.

daily (AATE,2018). Among the main reason for commuting are to work and to study, accounting for 32% and 27% of the total number of trips, respectively (MTC, 2013).

According to the TomTom Traffic Index (2022), in 2019 traffic levels increased by approximately 20% between February and March, the latter being the month that school classes started which suggests being influenced by school trips. Thus, children's trips to school may be a considerable contributor to traffic congestion at peak hours and therefore impact urban planning and sustainable mobility in Lima.

One phenomenon that characterize schools in Lima is its socioeconomic segregation among students which can be analysed from different angles including the spatial distribution. As the city of Lima is a segregated space, it is likely that younger students, especially those from lower socioeconomic levels attend schools in their neighbourhoods while those of higher socioeconomic levels attend to what they consider "better" institutions, as part of an aspirational mechanism (Garret et al., 2021), and therefore commute longer distances probably in motorized vehicles.

The rise in private motorized commuting trips to school in Lima have negative consequences on children's health and their attitudes towards sustainable mobility, and adverse effects on the environment and urban congestion, implying decreased active modes of commuting and decreasing reliance on public transport.

Therefore, it is important to understand parental perceptions of safety and their attitudes towards urban mobility since parents are the decision makers of their children's commute to school.

Likewise, there is a dearth of scientific research and literature on factors that shape their perceptions and eventually determine their decision of commuting mode to school.

1.1.1 Research Objectives

From the best knowledge of the researcher, Lima does not count on detailed information on child mobility or data regarding school trips. Against this backdrop, the main objective of the research was to identify the factors that influence parent's decision on commuting mode to school in the city of Lima (Peru). By controlling variables as distance to school and type of school (public or private), other factors like parent's safety perceptions on mobility may take a relevant role in this decision. Therefore, the specific objectives were:

- Examine the role of traffic and social safety perceptions while selecting the commuting mode to school.
- Identify which factors shape parent's perceptions on traffic and social safety towards the mobility of their children to school.
- Analyse parent's perceptions on traffic and social safety on the decision regarding the commuting mode to school across public and private schools.

1.1.2 Main research question and research sub-questions

Research question

Whether and to what extent do parental safety perceptions on urban mobility influence the decision on their children's commuting mode to school? : This question seeks to examine if parental safety perceptions on urban mobility have an effect on the

mode that children commute to school among active modes, public motorized modes, or private motorized modes.

Sub-research questions

1. **Which factors influence parental perceptions of traffic and social safety in relation to their children's commute to and from school?** : This question seeks to explore the factors that shape the traffic and safety perception that parents have regarding the mobility of their children to school.
2. **Which factors other than parental safety perceptions play a role in their decision-making regarding the mode of commuting of children to and from school?:** This question seeks to identify other factors besides parental safety perception on traffic and social safety that could explain the selection of the commuting mode to school for their children.
3. **What implications do parental perceptions and their decision-making regarding children's commuting mode to and from school have for sustainable urban mobility?:** This question seeks the effects that the selected commuting modes for children to school have on sustainable urban mobility.

1.3 Academic and practical relevance of the research topic

Children are known to imitate their parent's behaviour by adopting their choices and attitudes, including their travel behaviours for commuting. In this context, school commuting is a relevant area of study because of its potential long-term effects on younger generations' travel habits and its consequent impact on urban planning and sustainable mobility.

Understanding parents' safety perceptions of various modes of transportation, as well as the motivations behind mode selection decisions in school trips, is a critical issue because it can provide useful information to policymakers, transportation and spatial planners on how to overcome potential barriers and difficulties to meet all students' future mobility needs.

Most of the previous studies on school trips have focused on the direct physical structure impacts on school commuting mode but there is limited evidence of the role of the parental perception on school travel patterns decisions in developing countries where there are disparities in the social, economic, and cultural arenas; and where the national policies still prioritize the construction of car-centric infrastructure.

This research seeks to contribute to the urban mobility body of research for a better understanding of children's travel modes to school and the importance of taking into consideration the parents' safety perceptions in defining them. This topic covers multidisciplinary aspects that can help to guide and improve policies and enrich the development of studies that analyse more sustainable mobility decisions for children.

Likewise, this study can lead to further research regarding the mobility of children in Lima, patterns across the city, the impact on parents' perception of mobility, and the inclusion of elements such as land use and education availability to understand the selection of schools by parents and its implication on mobility in the city.

Chapter 2: Literature review & conceptual framework

2.1 State of the art: theories and concepts of the study

On the path to a more sustainable mobility in our cities, the promotion of commuting to school by walking or cycling has been recognized as a potential strategy to combat the rise in childhood obesity and establish from a young age a healthy lifestyle habit to last through adolescence and adulthood (Tudor-Locke et al., 2012). Moreover, several research has been motivated by the shift from non-motorized to motorized modes for commuting to school around the world (Mitra and Buliung, 2012, Bradshaw, 2001) which is associated with the reduction of air pollution, energy consumption, and social segregation (Banister and Lichfield, 1995).

Research motivated by the shift to motorized modes for commuting to school around the world has commonly studied factors such as urban form (Mitra and Buliung, 2012, Bradshaw, 2001) and sociodemographic characteristics to explain children's travel patterns to school. However, limited studies have included the impact of parents' perceptions in defining their children's mode to school. To McMillan (2005), until a certain age, parents or caregivers decide on the commuting mode to school for children and while distance is a determinant barrier for parents to active commuting to school (Mitra 2013), recent studies show that a walkable distance does not deter parents from driving children to school (Westman, Friman, and Olsson, 2017). In that sense, it is suggested that parents' perceptions may have a stronger effect than urban form on the decision on commuting mode to school (McMillan, 2005).

As mentioned, a vast number of researchers have studied among adults' behaviour the association between the urban form with lower rates of vehicular travel. Factors such as higher densities, mixed land uses, and urban designs oriented to be more pedestrian-friendlier were found to encourage non-motorized travel modes (Cervero and Kockelman, 1997), particularly walking. In the case of children, several studies have found a similar relationship considering urban factors such as block density, good sidewalk connectivity, and signalized intersections to explain active travel patterns to school (Mitra and Buliung, 2012, Bradshaw, 2001).

Furthermore, several studies have focused their attention on the factors that influence the travel behaviour of children to school. Most of these studies have been developed considering parents' opinions and thoughts regarding their children's commuting behaviour to school. Distance from home to school has been commonly found among parents as a strong factor when choosing their child's commuting mode: longer distances become a main obstacle for choosing walking or cycling (Dellinger and Staunton 2002, Larsen, Gilliland and Hess, 2012). Research also suggests that parents' attitudes toward convenience should be considered as there is evidence that driving to work increases the likelihood to drop off their children at school which reduces the probability of choosing active modes (Deka, 2013). The socioeconomic characteristics of children such as age, gender, and household income, besides, are suggested to influence parents' decisions in school's commuting mode (Dias et.al.,2022).

Larsen, Gilliland and Hess (2012) argue that results from studies focused on children are more mixed than on adults and it is unclear how the urban form and children's active travel are related. According to a study run by McMillan (2007), perception variables of caregivers, such as attitudes about transportation safety and social standards in different geographies are more essential than urban form in determining the mode of transportation for school trips. Parents who are more concerned about transportation safety and personal security in their area or on the streets where their children go to school are less likely to select walking as a form of transportation for their children (McMillan,2007).

The influence of perceptions of social and traffic safety has been studied mainly in developed countries finding that in comparison to Europe, active school transportation in North America and Australia was more frequently associated with social and traffic safety perceptions (D'Haese et.al.,2015). Nevertheless, there is a lack of information across Peruvian populations (D'Haese et.al.,2015) which is the gap this study intends to fill.

The assumption of this study is that active school travel can benefit both the environment and human health. In order to enhance active school travel behaviors, it is important to understand the factors that influence parents' choices. This will help in the development more accurate interventions by practitioners and authorities.

2.1.1 Sustainable mobility and school commuting

2.1.1.1 Sustainable mobility

The evolution of concepts in mobility has closely followed the development and needs of cities in each period of time. While each city's development was different, a trend towards territorial expansion could be seen in common, giving rise to the use of motorized vehicles (Pozueta, 2009) and the development of traditional transport planning based on reducing time and cost of trips (Banister, 2008). As a response of decades of indiscriminate use of motorized vehicles, sustainable mobility has emerged as a paradigm that acknowledges that physical dimensions such as urban form and traffic, should be balanced by social dimensions such as people and proximity (Banister, 2008).

The debate on how to address sustainable mobility is becoming more frequent among cities and different stakeholders. The variety of conceptions that are raised has increased the concerns about how to define, measure, analyzed, and evaluate it (Berger, 2014). Despite this, a consensus can be found in the literature on the objectives of sustainable mobility, which seeks to reduce polluting emissions from urban transport, reduce car-centric design in cities, and reduce the need to travel long distances while prioritizing more environmentally friendly modes of travel as walking and cycling (Banister, 2008).

2.1.1.2 Children in sustainable mobility

In the paradigm of sustainable mobility, it arises the interest that each social group has its own set of needs and accessibility to the services (Wiel, 1999). One of these groups is children, who are mainly dependent on others to provide transportation considering their vulnerability on the traffic as their physical, psychological, and cognitive capacities are in development (Cabrera, 2019).

Children are users who are poorly served by urban transportation in cities. The welfare of children has been neglected in order to accommodate the rise of private car use (ITDP,2021). Furthermore, children face safety threats daily from traffic crashes, health risks from air pollution, and crime situations which means that parents often prevent them from walking or cycling on the street. Tonucci (2009) points out that the impossibility of satisfying the primary needs of children, such as walking and experiencing the environment in the years in which their personality is built impairs the development of calm, responsible, and conscientious people and has a great personal cost. However, many cities show that they are not designed to support children`s mobility and safety, so it is understandable that for parents is inevitable to protect them by restricting some freedoms.

2.1.1.3 School commuting

A habitual trip that children make is to school. In the last decades, commuting modes to school by walking or cycling have decreased while trips made by car have increased (Wen et al., 2008; Faulkner et al., 2010). Under this context, school commuting is a relevant area of study because of its potential and long-term effects on younger generations' travel behavior and its impact on urban planning and sustainable mobility.

In most developed countries children's commuting mode to school is by car. In a survey carried out in Australia, it was found that the majority of children (58%) were driven to school by car; parents indicated as main reasons for choosing this mode because is the quickest and safest form of transport (RCH,2019).). In a study developed in the United States among pupils in the age range of 5 to 14, the family automobile accounted for 46.3% of trips to school followed by the school bus (39.6%), and only 14% usually walked to school; distance and traffic hazards were the two most frequent barriers among students who did not typically walk to school (Beck and Greenspan, 2008).

In less developed countries, active modes to school account for higher rates than in developed countries. In a questionnaire carried out in Benin (Nigeria) walking accounted for more than 65% as commuting mode to school. In Bogotá (Colombia), 60% of children walk or cycle to school according to the Municipality of Bogota (Alcaldia Mayor de Bogotá, 2021). Nevertheless, in a self-report questionnaire developed in a study in the central region of Ecuador, the most common mode for commuting to school was by car with a rate of 43.4% (Barranco-Ruiz et.al.,2008) suggesting that modal splits can change among different groups of study in developed and developing countries.

Within this context, in many cities worldwide, practitioners as policymakers and planners have implemented programs and actions to encourage active modes to commute to school. Programs such as “walking school buses” and “bicycle trains” promote caregivers to escort children to school by foot or bike from a previously agreed meeting point (Kingham and Ussher, 2007). Likewise, projects a Safe Routes to School aims to improve the built environment and traffic infrastructure to boost walking and cycling among children (McDonald N. et al, 2013).

2.1.2 Overview of the perception and safety concepts

Perception is associated with a cognitive process based on receiving and selecting information that builds a mental image of the environment around according to each person's knowledge and values (Golledge and Stimson, 1997). The importance of studying perceptions relies on the fact that they guide individuals' actions and motivations (Ferraro, 1995). Furthermore, built environments are the result of decisions related to how people perceive their spaces and times (Golledge and Stimson, 1997).

“Safety” is associated with the opposite of risk (Boholm, 2015) while “risk” relates to the expectation of an undesirable outcome (Hamed and Al Rousan, 1998). According to Adams (1995), the response to risk is risk compensation or in other words, taking safety measurements. As every individual has their own unique perception of reality and therefore of risk, the more risk is taken, the more positive or negative outcomes can incur (Blokland and Reniers, 2020).

Perceived risk can restrict a person's behavior, and encourage inactivity and sedentary lifestyles, which can have a negative impact on health (Loukaitou-Sideris, 2006). On that line, an environment perceived as risky or unsafe may lead people not to mobilize in

actives modes such as walking or cycling considering that they would be directly exposed to environmental threats. In the context of this study, it is evident that if parents perceive an unsafe environment during school trips, they would take all possible safety measures to protect their children. Based on McMillan's framework (2005), parental safety perceptions regarding children's mobility to school are built up from traffic safety and social safety perceptions.

2.1.2.1 Traffic safety perception from the perspective of parents

Traffic safety or traffic safety involves the evaluations and strategies to reduce the risk of traffic crashes and their consequences (Tisca et al., 2016). Traditionally, traffic crashes were treated as accidents, that is sudden and unexpected events (Wegman, 2014). Nevertheless, current trends address traffic safety as a system that needs to be tackled from different elements: people's behaviours, traffic infrastructure, vehicle design, safe speeds, and post-crash responses (U.S. Department of Transportation, 2022). The acknowledgment of traffic users' behaviours in the strategies to improve traffic safety positions the study of perceptions as a crucial area of focus.

One of the most vulnerable groups of traffic users is children, especially those who are pedestrians on poor driving environments, leading to the increase of pedestrian crashes which is one of the primary health risks that children face in developed and developing countries (WHO, 2022). Under this situation, parents' perceptions of traffic safety appear to play a significant role in how children commute to school. If parents believe that sending their children to school on foot increases the risk of an accident and the severity of the consequences, they will opt for motorized transportation modes, such as a private automobile, rather than active transportation, such as walking (Mehdizadeh et al., 2017).

2.1.2.2 Social safety perception from the perspective of parents

Social safety is a primary concern among parents which may cause parents to restrict children to commute by active modes. In developing countries' context, social safety issues may have a more important role than in developed countries where this is rather uncommon (Shutt et al., 2007). Holtmann and Van Vuuren (2007) identified in South Africa that children who commute to school daily on foot or by public transportation are exposed to potential anti-social conduct and criminality. Kruger and Landman (2007) observed that, in comparison to users of automobiles, those who used public transportation and non-motorized transportation (NMT) were more likely to experience the effects of crime and anti-social conduct. According to reports, parents believe the consequences of kidnapping or assault are much more horrifying than the more usual consequences of accidents on the traffic (Godfrey et al., 1998). In this context, social safety such as the fear of crime and child abduction may be a barrier to active travel. However, de Paula (2018) argues that when looking into the social safety variable, the results among several studies differ. For example, in a study in Nairobi (Kenya), Muthuri et al (2016) did not find associations between the perception of crime and active commuting. In view thereof, the relation between the social safety variable and its effect on active commuting may be highly dependent on the area and context of study.

2.1.2.3 Urban form

A common consensus among the academia is that sustainable mobility is linked to the urban structure considering that it may influence citizen movements and hence, their

mobility choices (Dextre and Avellaneda, 2014). On the path towards sustainable mobility, a topic that is being extensively studied is the relationship between urban structure and active modes such as walking. People's perceptions of pedestrian safety and their choice to walk are influenced by the design of pedestrian environments as the availability and conditions of sidewalks, buffer areas, and the presence of safe crossing (Kweon et al., 2021). Ahlport et al. (2008) found that in Tehran (Iran) a barrier to getting to school was the lack of sidewalks or the discontinuity of sidewalks since they increased the hazard of walking to school. On this basis, the conditions of walkways may influence parents' safety perception and their willingness to allow their children to walk to school.

Within the study of urban form, land uses and the availability of education services such as schools are crucial elements of focus for transportation mode choices. In that sense, distance to school has been one of the main factors in studies on how school-aged children commute (McMillan, 2007, Ahmadi and Taniguchi, 2007, Wen et.al.,2008, McDonald,2008). Considering that higher distances are negatively correlated with choosing active modes to commute to school.

2.1.2.4 Past experiences

Each person's experiences, memories, and relationships to space result in highly complex feelings of fear of crime or traffic (Koskela, 1997). One's perception of a place's safety may be influenced by past experiences with its safety and how familiar it is. Therefore, based on past encounters as well as the reputation given by other actors such as media reports and others' experiences, humans create a mental image of unsafe zones and dangerous environments (Koskela and Pain, 2000). In the absence of prior experiences and knowledge of a particular area, people's assessment is likely to be based on preconceived notions of similar places (Valentine 1990).

2.1.3 Socioeconomic environment

The relationship between perceived safety and active mobility may be influenced by moderating factors that vary among individuals, social groups, and environmental settings. Variables such as gender, age, household income, and school type may play a significant role for parents in determining the school transport mode (McMillan, 2005, Loukaitou-Sideris, 2006). In open spaces, safety appears to be a major concern, especially for women and girls (Loukaitou-Sideris, 2006).

According to McMillan et al. (2005), families with lower socioeconomic levels are less likely to utilize a car, possibly due to lower ownership rates. Despite active commuting to school is more common in lower-income areas (Larsen, Gilliland and Hess, 2012), several studies show that built environment barriers to walking such as safety are high. For instance, Ross (2000) discovered that people of underprivileged communities in Illinois experienced greater degrees of fear of being victimized in comparison with people of wealthier communities; nevertheless, despite their fear, they walked for necessity.

Among other studies, it can be found that parents select the mode of transportation as the "easiest and most convenient", particularly for those who needed to complete multi-activity trips (Faulkner et.al, 2010). In a study carried out in Iran, Mehdizadeh et al. (2017) found out that parents who valued convenience and accessibility were more likely to prefer motorized modes.

Furthermore, the choices made by parents about a child's means of transportation to school may be influenced by their attitudes and opinions. According to Kitamura, Mokhtarian, and Laidet (1997), a person's attitude such as whether they are pro-environment, pro-transit, a workaholic, or automobile fan, is a good indicator of their travel habits.

2.1.4 Related studies in Lima, Peru

In Lima, limited studies regarding the mobility of children have been conducted. One of these studies found out that a low socioeconomic position, a lack of parental education, exposure to traffic on the way to school, an absence of adult supervision during outdoor play, and the length of outdoor play were all statistically significant with traffic traffic injuries in children. (Pernica et.al, 2012).

In another investigation based in a low-income area in Lima, it was discovered that increased traffic volumes and speeds, a greater density of street vendors along a given stretch of traffic, and lack of lane demarcation are all factors that increase the risk of a pedestrian child being part of a traffic crash (Donroe et.al., 2008).

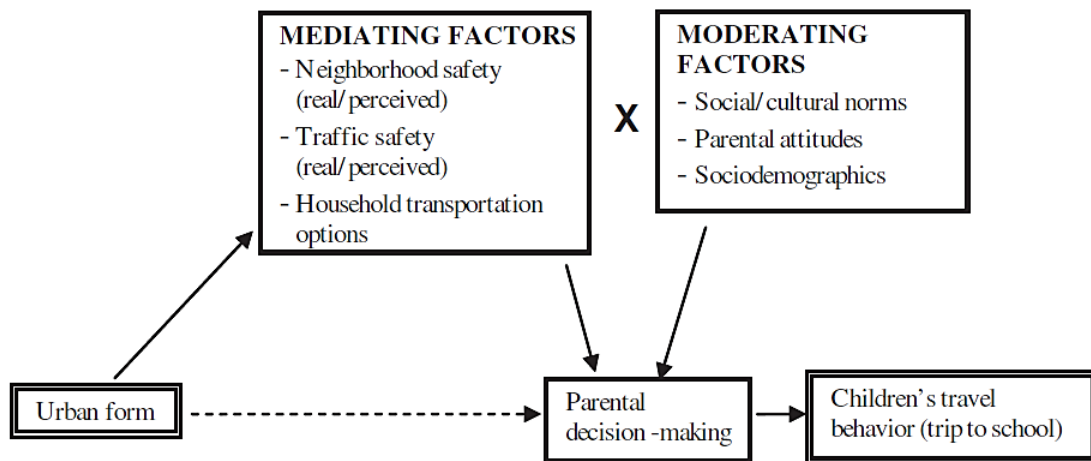
The present research contributes to filling the gap of the need for research regarding children's mobility in the city of Lima and the first to analyse the relationship between parent's safety perceptions and transportation mode choices to school.

2.2 Conceptual framework

The conceptual framework of this thesis is based on the one proposed by McMillan (2005) which assumes parental decision-making as an intermediate causal variable of children's commuting modes (Graph 1). McMillan's model suggests that given the urban form, there are mediating factors such as social and traffic safety, real and perceived, that influence the parental decision of children's travel mode to school. However, based on the theoretical underpinning and recent studies, this study presents an adapted conceptual framework to that of McMillan's, suggesting a distinct structural relationship for the case of Lima, a city in a developing country, between parents' safety perceptions (dependent variable) and children's commuting mode to school (independent variable). The conceptual framework in Graph 2 starts pointing out two main parameters that shape parents' safety perceptions (traffic and social safety); urban form (McMillan, 2005) and past experiences (Mehdizadeh et.al, 2017). Each of them has measurable indicators which are mainly subjective. The influence of parents' safety perceptions can be positive or negative toward active modes, therefore the strength of the relationship for this study is affected by the socio-economic characteristics, a moderating factor that can amplify or weaken the relationship between the independent and dependent variables (Baron and Kenny 1986). The significant socio-economic characteristics elements are social/cultural norms, parental attitudes, age, gender, income, vehicle ownership, and education.

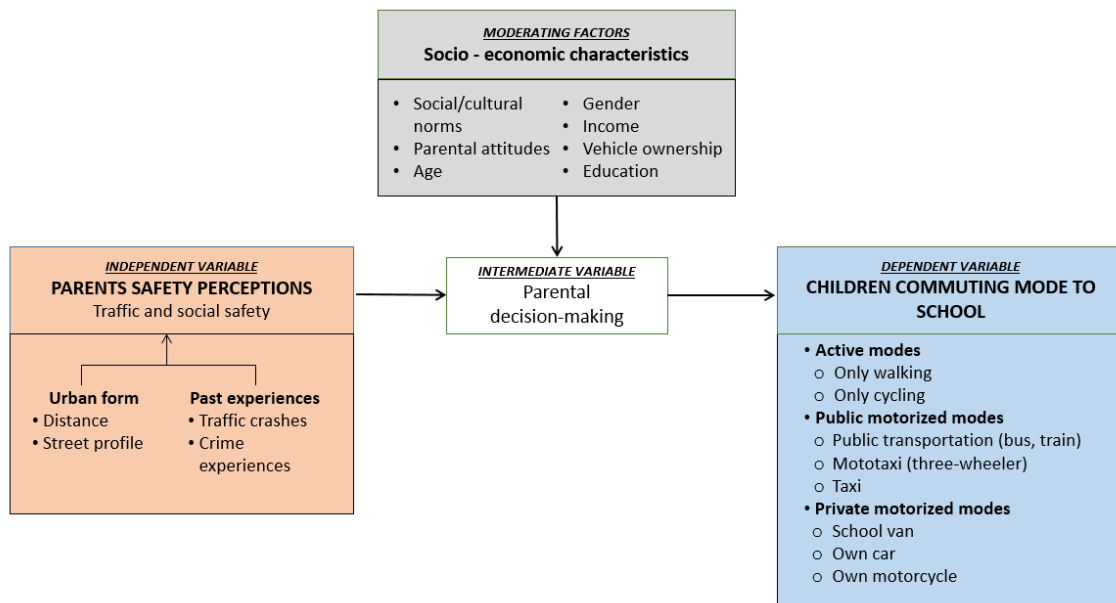
Based on the theory and the aim of this research to test it, the first hypothesis proposes that parent safety perceptions (traffic and social) predict the commuting mode to school. The second hypothesis proposes that distance and the street profile to school first shapes traffic safety and social safety perceptions of parents, and then based on these perceptions, decide the commuting mode to school of their children. The third hypothesis proposes that, considering the location of the study in a developing country, income have a relevant participating in the selection made by parents of the commuting mode to school.

Graph 1: McMillan's Framework



Taken from: McMillan (2005)

Graph 2: Conceptual Framework of this study



Adapted from: McMillan (2005)

Taken from: Mehdizadeh et.al (2017), Kweon et al. (2021), Faulkner et.al (2010) and Kitamura, Mokhtarian, and Laidet (1997)

Chapter 3: Research design & methodology

3.1 Operationalization

This section describes the transition from the theoretical concepts into empirical research. As first step, the concepts of this study were defined based on the literature review:

Table 1: Definition of concepts

Concept	Type of variable	Definition
Parent safety perception: traffic and social safety	Independent variable (x): also denominated as the predictor variable which generates the effect in a relationship (Field,2009).	Parent`s subjective judgment concerning a potential unfavorable event that could occur (Adams 1995) regarding traffic safety (Mehdizadeh et al., 2017) and social safety (DiGuseppi et al. 1998), shaped by elements in the built environment (Kweon et at., 2021) and previous experiences (Koskela and Pain, 2000).
Socio-economic characteristics	Moderating variable: “A moderator is a qualitative or quantitative variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable” (Baron and Kenny 1986, 1174).	Children`s personal profiles and parents` attitudes, socio-cultural norms, and economic profiles in the selected area of study.
Parental decision-making	Intermediate variable: a factor that appears along a causal relationship from a dependent variable to an independent variable (Oxford Reference, 2022)	Parents` selection of the transport mode for their children to commute to school influenced by their safety perceptions (independent variable) and socioeconomic characteristics (moderating variable).
Children commuting mode to school	Dependent variable (y): also denominated the output or response variable on function of the changes of the independent variable (Ross, 2017).	Mode of transport in which children commute to school (Lima Como Vamos, 2021)

Author (2022)

Furthermore, the research question and conceptual framework were operationalized by variables and measurable indicators as follows:

Table 2: Operationalization table

Main variables	Sub-variable	Indicator	Type of data	Source of data
Parent safety perception - Traffic and social safety (Independent variable)	Urban Form			
	Travel distance	Distance from home to school (km)	-Primary -Secondary	-Parent`s questionnaire -Secondary data
		Whether the distance to school is perceived as walkable and/or perceived as distance that children could cover cycling comfortably	-Primary	Parent`s questionnaire
	Profile of the trip network: characteristics of a particular the	Availability and quality of infrastructure •Places for walking (Scale 0-4). See component in Appendix 2 – Table 3 – Item 2	-Primary	-Parent`s Questionnaire -Informant in-depth interviews

	travel route to school	<ul style="list-style-type: none"> • Places for cycling (Scale 0-4). See component in Appendix 2 – Table 3 – Item 2 		
		Perceived elements of safety <ul style="list-style-type: none"> • Level of perception of traffic safety (Scale 0-4). See component in Appendix 2 – Table 3 – Item 3 • Level of perception of social safety (Scale 0-4). See component in Appendix 2 – Table 3 – Item 4 	-Primary	-Parent´s questionnaire -Informant in-depth interviews
	Past experiences			
	Traffic crashes	Involved in a traffic crash or relatives/friends involved in a traffic crash as pedestrians or cyclists.	-Primary	-Parent´s questionnaire -Focus groups
	Crime experiences	Involved as victims in a crime situation or relatives/friends involved as victims in a crime situation as pedestrians or cyclists.	-Primary	
Socio-economic characteristics (Moderating variable)	Socio-economic factors			
	Children´s demographic profile	<ul style="list-style-type: none"> • Age • Grade • Gender 	-Primary	-Parent´s questionnaire -Focus groups
	Parental attitudes	<ul style="list-style-type: none"> • Convenience of driving to school (chain trip) 	-Primary	
	Social and cultural norms	<ul style="list-style-type: none"> • Car-centric behavior (Scale 0-4): a transport lifestyle based on the car. • Environmental-conscious (Scale 0-4): on the implications of transportation on the environment. • Health-conscious (Scale 0-4): on the implications of transportation on the health of people and oneself. 	-Primary	
	Economic profile	<ul style="list-style-type: none"> • Household income (Soles: currency of Peru) • Motor vehicle ownership • Education level 	-Primary	Parent´s questionnaire
Children commuting mode to school (Dependent variable)	Modal split	<ul style="list-style-type: none"> • Active modes: Only walking, only cycling. • Public motorized modes: bus, train, mototaxi (three-wheeler) taxi. • Private motorized modes: school van, own car, own motorcycle. 	-Primary	-Parent´s questionnaire -Focus groups

Author (2022)

3.2 Research design

3.2.1 Methodology

In order to test the conceptual framework of this study and considering that the data required to answer the research question was either non-existent or insufficient, an empirical data collection technique and quantitative approach were necessary. Furthermore, the study had a descriptive and comparative objective among the target population between public and private schools in the context of the city of Lima (Peru). The research strategy selected was a survey, which is the one that better aligns to answer the research question considering that it “provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population” (Creswell, 2007, p.29). Likewise, a survey design was preferred taking into account a

large number of research units, in this case, parents, and a large number of variables to be analysed.

To intend achieving data triangulation, it was employed mixed-methods of research by integrating quantitative and qualitative instruments. The quantitative instrument selected was a questionnaire to identify the determinant variables influencing the decision about a child's commuting mode to school. The qualitative instruments were used for interpretation and cross validation of findings acquired from questionnaires and further explore parents' views. The qualitative instruments selected were focus groups with parents to achieve a deeper understanding of their perceptions (Caillaud and Flick, 2017) and semi-structured interviews with practitioners on urban form and mobility of the city of Lima to develop a complementary understanding. Finally, secondary data was revised including reports and statistics regarding mobility patterns in Lima to have a comprehensive view of the context.

3.2.2 Delimitation of the target group

In accordance with the literature review, the strategy for the delimitation of the target group for data collection followed the next considerations:

1. Selection of elementary school children aged 6 to 10 years across grades 1 to 4 in the city of Lima as parents are most likely to be decision makers of school commuting modes for this age group.
2. Comparison of modes of commuting to school between public and private school children: Socio-economic characteristics and specifically household income level may be likely to act as a moderating variable with an impact on the modal decision of parents.
3. Controlling for distance to school while selecting schools: The study is designed to select only those neighborhoods/areas where maximum number of elementary school children reside within walking/cycling distance from the school given that by increasing distance between school and home implies an association with an increased proportion of motorized modes for commuting to school.

3.3 Data collection methods

The employment of mixed-methods research included:

3.3.1 Survey - Questionnaires

A survey enables the researcher to gather a significant amount of data on a large number of units of study (the respondents) which for this research are parents. The researcher uses defined measurement techniques for data collection, like answer scales or numerical answer categories. (Fowler, 2009).

The instrument for data collecting from a survey is the questionnaire., which is a series of questions prepared beforehand, both open-ended and closed, that are derived from the study's variables (Van Thiel, 2014). The questionnaire was composed of 23 questions that, aligned with the conceptual framework, was structured into different categories including personal characteristics, household characteristics, commuting modes to school and level of importance of several factors using a rating scale 0-4. (see Table 1 in Appendix 2). Furthermore, based on their experiences and perceptions, parents were asked to rate how much they agreed with statements related to four domains: urban form,

traffic safety, social safety and attitudes towards sustainable mobility. These questions were formulated by employing an adaptation of a tool for assessing environmental walkability denominated Neighbourhood Environment Walkability Scale (NEWS) which is based on aspects of walking-friendly neighbourhoods' perceived sustainability (Starnes et.al., 2014). The questionnaire was arranged in English and translated into Spanish for the fieldwork.

3.3.2 Focus groups

A qualitative primary data collection method based on an open discussion on a topic with several participants (Van Thiel, 2014). The aim of the focus groups was to have a deeper understanding of the safety issues parents take into account for their children's mobility to school. Likewise, to know if they are aware of sustainable mobility implications and contrast their responses with the results of the questionnaire. Parents who participated in the focus group filled the survey beforehand.

3.3.3 Semi-structured interviews

This qualitative research method is based on a conversation with one or more respondents (Van Thiel, 2014). For this study, semi-structured interviews were run with two practitioners in Lima, one dedicated to the urban form development of the city of Lima and one from the urban mobility sector. A set of questions were prepared beforehand to have a deeper understanding of the dynamics of the urban development in Lima, the traffic conditions that characterize the city, and their relationship with children's mobility.

3.3.4 Secondary data

Available information such as reports on mobility patterns and the urban form of Lima will be obtained from official reports and statistics of the city.

The research instruments can be found in Appendix 1.

3.4 Sampling and selection

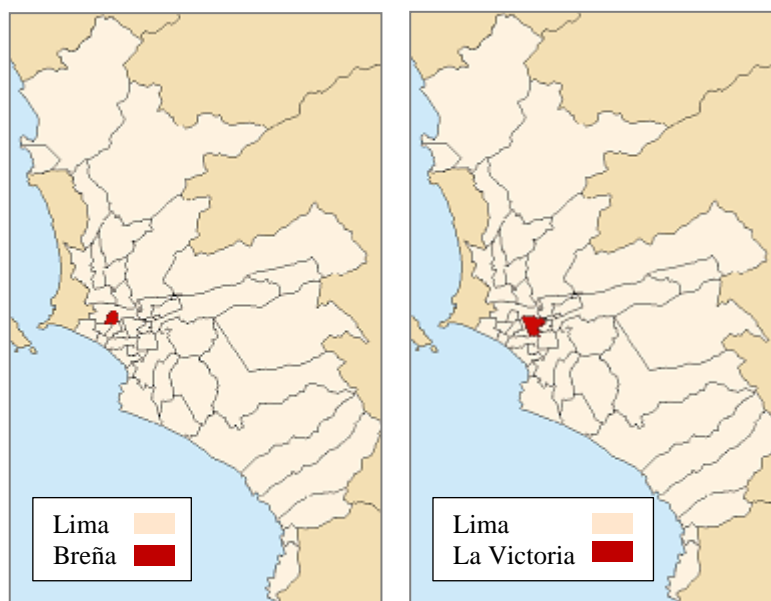
Quota sampling technique was used to define the geographic boundaries of the target population. The province of Lima is divided into 43 areas denominated "districts". Because of time limitations, it was not possible to reach the entire target population in the 43 districts, so it was determinant to use a purposive sampling technique to make the selection of the districts or districts to be studied. Therefore, a specific criterion was employed to approach with a higher probability the application of the survey to the target population by determining the districts which:

1. Have a higher number of children who live and attend school in the same district (Figure 1)
2. Districts in which the distance between their perimeter limits (administrative boundaries) is less than 3 km (maximum distance prescribed to be covered by active modes) to obtain a catchment area (Figure 2).

Two districts followed the mentioned criteria: Breña and La Victoria, which were selected to run this study (Figure 1). Therefore, the study group are parents from elementary public

and private schools of the districts of Breña and La Victoria with children aged 6-10 years old.

Figure 1: Location of the district of Breña and La Victoria respectively, Lima



Taken from: Wikipedia (2007)

In the district of Breña there are 46 schools of which 36 are private and 10 are public while in La Victoria there are 80 schools of which 50 are private and 30 are public (Ministerio de Educación, 2022). Using purposive sampling techniques, two public and two private schools of the districts of Breña and La Victoria (one in each one) were aimed to be selected as the target group of study. Considering that for central limit theorem to hold, sample sizes of 30 or more are frequently regarded as sufficient (Ross, 2010), hence the sample from each school was composed of 30 parents who live in the catchment area defined.

Table 3: Sample size calculation

Type of school	Number of expected responses
Public school 1 - Breña	30
Public school 2 - La Vitoria	30
Private school 1 - Breña	30
Private school 2 - La Vitoria	30
Total	120

Author (2022)

3.4.1 Survey administration

During the data collection phase, the researcher visited several public and private schools in both districts with the aim to talk to the principals, explain the study objectives and ask if they were interested in participating in it. Although the researcher discussed with several principals from schools of La Victoria, they were not interested in being part of the research. On the other site, principals of schools from Breña showed their support in participating and the sample was adapted to consider two public and two private schools from only the district of Breña.

To administer the questionnaires, schools' principals who gave their consent and accepted to help contact the parents gave a previous feedback regarding which questionnaire

modality would be better to use to collect parents' answers. To ensure that every question in the questionnaire was clear and understandable, this tool was first provided to school principals and external parents to revise it and receive feedback for improving its accuracy.

Considering it, the questionnaires were administrated in two modalities:

- Virtually by sending a link to parents via email. The principal's suggestions were to use Google Forms as the questionnaire platform as it was "friendlier" for parents to fill. The link to the questionnaires was sent to all parents from the 1st, 2nd, 3rd, and 4th grades of elementary level of two private schools and one public school from the district of Breña. Principals consented to give the researcher the main email address of contact for each grade with which it was possible to send all parents the survey.
- Paper-based by providing hard copies that were sent with children for their parents to fill them at home and return them to school two days after so the researcher could collect them. Hard copies of questionnaires were sent to all parents from the 1st, 2nd, 3rd, and 4th grades of elementary level of one public school from the district of Breña.

Table 4 summarizes the number of responses received:

Table 4: Number of responses

Type of school	Modality of questionnaire	Number of expected responses	Number of final responses
Public school 1 – Breña	By virtual link	30	83
Public school 2- Breña	By hard copies	30	30
Private school 1- Breña	By virtual link	30	31
Private school 2- Breña	By virtual link	30	34
Total		120	178

Author (2022)

3.5 Reliability and validity

To elevate the reliability and validity of the study, it was employed mixed-methods of research by integrating quantitative and qualitative instruments and perform cross validation of the data among the different sources that this study considers, including secondary one.

The selection of respondents was not based on the researcher's intuition but rather on a catchment acceptable for walking and cycling to access schools which delimitation was based on secondary data. This further increases the reliability and validity of the thesis.

Internal reliability was tested using Cronbach's alpha test. Rules of thumb on the Cronbach's Alpha (α) are:

Table 5: Rules of thumb on the Cronbach's Alpha

Spearman correlation	Rule
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Taken from: Keith (2017)

However, for a variable with a scale with less than 10 items, $>.6$ is an acceptable α (van Griethuijsen et al., 2014). Thus, variables whose alpha coefficient was > 0.6 for scales with less than 10 items were acceptable while the recommended minimum of 0.7 was considered for scales with more than 10 items.

Due to the inapplicability of findings to larger groups, external validity was limited. However, these findings can be used for further and deeper research for developing areas.

3.6 Data analysis methods

Based on the data collection tools, quantitative and qualitative analysis methods were used to interpret the data.

3.6.1 Quantitative analysis

It includes the analysis of quantifiable data obtained from parents' questionnaires. It should be assigned as much as possible scores to variables to facilitate logical and unambiguous information from responses (Van Thiel, 2014). The order process of analysis is summarized in Figure 2.

Figure 2: Process of quantitative analysis



Taken and adapted from: Van Thiel (2014)

The questionnaire measured the factor's relation with commuting modes to school in categorical variables which were coded in Stata 16 as ordinal or nominal values. Indicators measured in Likert scales were combined into scale variables derived from the research topics, while others were examined individually. To give categorical data a numerical value, the variables in some cases were converted into 0/1 dummy variables.

By developing contingency tables and graphs, the frequency and distribution of responses for the different variables that this research poses were described. Likewise, this allowed to summarize and identify meaningful information for the next steps of the analysis.

Subsequently, to test the extent and direction (positive or negative) to which the independent and dependent variable were related, correlations were conducted. Considering that the type of data gathered was nominal and ordinal scales (ranks), non-parametric Spearman correlations were requisite to be performed between the dependent and independent variables. In order to interpret Spearman correlations, this thesis employs the next interpretation for both positive and negative relationships:

Table 6: Interpretation of correlation values

Spearman correlation	Interpretation
≥ 0.70	Very strong relationship
0.40 – 0.69	Strong relationship
0.30 – 0.39	Moderate relationship
0.20 – 0.29	Weak relationship

0.01 – 0.19	No or negligible relationship
-------------	-------------------------------

Taken from: Leclezio et.al (2015)

Finally, to test whether the independent variables influence the dependent variable proposed for his study, chi-square test, also known as Pearson's chi-square test were performed. This a non-parametric statistic used to assess the association between two or more categorical variables. The chi-squared test is formulated as:

$$x_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where:

O = Observed frequencies

E = Expected frequencies

C = Degrees of freedom.

To apply the chi-squared test, there are some assumptions that the data must meet (Kent State University, 2022):

- Between two categorical variables.
- Two or more categories (groups) for each variable.
- Independence of subjects: there is no relationship between the subjects in each group.
- Relatively large sample size: the expected frequencies should be at least 5 for the majority (80%) of the cells.

The chi-square test is a proof by statistical contradiction of Karl Pearson's null hypothesis H_0 , which states that if variables are not connected to one another, the null hypothesis is rejected by the research (Lyman & Longnecker, 2001). For this study, the test was conducted in the software Stata 16. To be 95% certain that there is a significant correlation between two variables, the chi-square test's p-value obtained by Stata must be less than 0.05. This means that there is a probability of less than 5% to reject the null hypothesis when it actually is true. Furthermore, the significant relationship will have a 99% confidence level if the p-value is less than 0.01.

3.6.2 Qualitative analysis

For non-numerical units of information, it will be employed qualitative analysis methods. The data recorded as statements and fragments from focus groups and interviews were coded using the software ATLAS.ti which provides effectiveness by analysing data systematically (Van Thiel, 2014). Both focus group and semi-structured interviews were recorded, transcribed, and translated from Spanish to English. The fragments were coded so that they can be grouped into categories derived from the conceptual framework. In Figure 3 can be visualized the qualitative analysis process

Figure 3: Process of qualitative analysis



Taken and adapted from: Van Thiel (2014)

The fragments of focus groups and in-depth interviews were categorized by identifying those extracts that showed a relation among the variables proposed in conceptual framework in order to validate the finding of the survey.

3.7 Expected challenges and limitations

It is important to describe the limitations during the data collection phase of this thesis. The study is focused on the urban zone of Lima. Two districts of Lima met the criteria developed for being part of the study: Breña and La Victoria. However, only schools from the district of Breña were willing to participate in the research, therefore the answers and results were based only on the parents of these schools.

In Peru schools reopened for face-to-face classes in March 2022 after two years of remote classes because of the Covid-19 pandemic. The data collection period was run in June 2022 and while students were attending face-to-face classes, some Covid-19 restrictions still applied in Peru as the use of facemasks in public spaces. For running the face-to-face focus groups, parents had to repeat sometimes their answers so they could be heard by other parents and the researcher. Likewise, one focus group had to be run by Zoom platform where it was noted that parents were less willing to share their thoughts in comparison to the face-to-face focus group.

The modality of virtual survey presents possible issues regarding the quality of the data that was obtained. As only a group of parents received the invitation to fill out the survey, there was not a 100% of equal chance to be filled by all parents. In addition, although the survey instructions indicated contact information for the researcher in case there were any doubts about filling out the questionnaire, filling it out in the presence of the researcher could have provided a greater opening for clearing up doubts than contacting her by telephone or e-mail, which could have represented a barrier to communication.

Chapter 4: Results, analysis and discussion

178 responses were collected and validated. For analysis purposes of this thesis, responses were disaggregated among public and private schools.

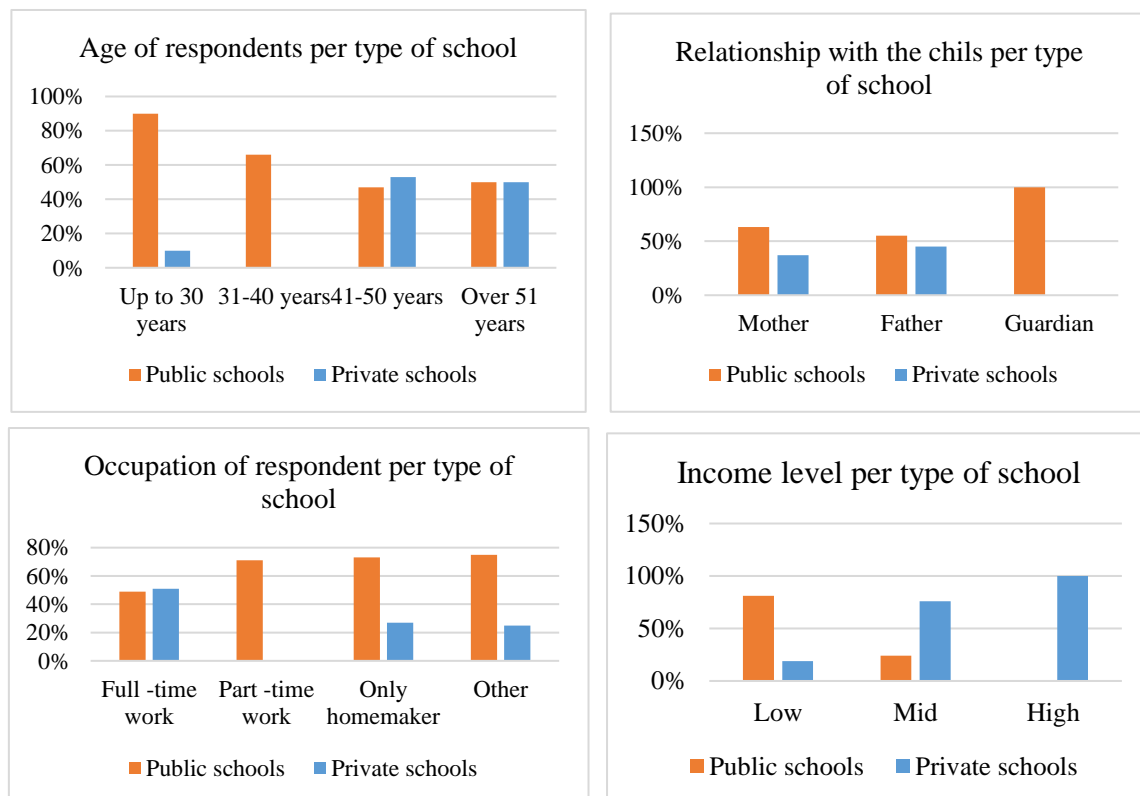
4.1 Socioeconomic profile of survey respondents

Respondents' sociodemographic attributes are presented in Graph 3. Particularly, in public schools, the group of respondents up to 30 years accounted a 90% of the responses of this group; this frequency of responds balances with private school in the older age ranges. A notable gender distinction was observed, with mothers dominating the responses at a cumulative of 86% of the total sample. Likewise, mothers were the main respondents in public schools (63%) while fathers were similarly distributed among public and private schools (55% and 45% respectively). While respondents from both public and private schools present similar frequencies for the group with full-time jobs, respondents from public schools have a more notable representation for the groups with part-time jobs and only homemaker (71% and 73% respectively). In income level terms, a critical observation was that 81% of low-income households depend on public school, 76% of mid-income in private schools and no high-income household was observed in public schools. An excerpt from the in-depth interviews illustrates this with the following:

“State schools have lost prestige and education is not as good as it used to be. Since education is free, mostly low-income families are the ones who enrol their children there, the others who can pay, enrol their children in private schools”. – Interviewee 1

No respondents with low-education was identified in private schools.

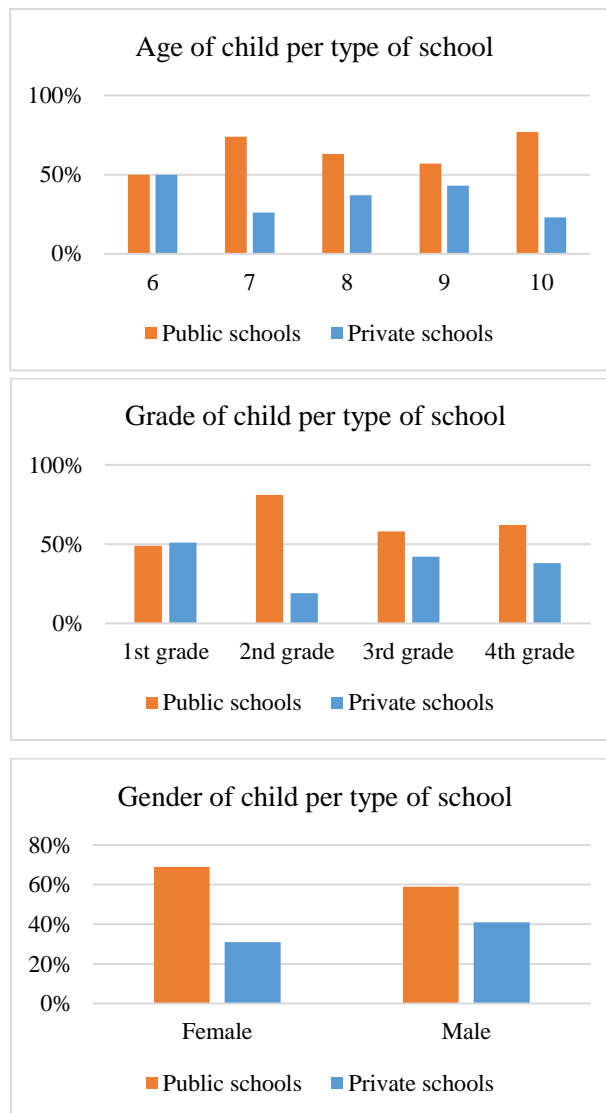
Graph 3: Socioeconomic profile of respondents



Author (2022)

Regarding children attributes (Graph 4), the sample was mostly represented for all ages (6-10) and grades (1st-4th) by students from public schools. In terms of age, the survey yielded a 1:1.2 gender ratio for the complete sample with 46% female and 54% male children. Female and male children reached a higher representation in public schools with 69% and 59% respectively.

Graph 4: Sociodemographic profile of children (Information provided by parents)



Author (2022)

4.2 Influencing factors on parental perceptions of social and traffic safety

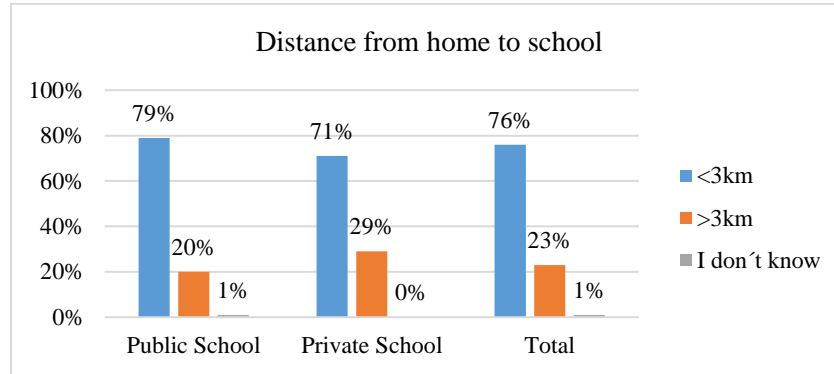
According to the conceptual framework proposed for this study, urban form and past experience factors were analysed whether they influenced parental perceptions of social and traffic safety in relation to their children’s mobility to and from school.

4.2.1 Urban form

4.2.1.1 Distance

The survey shows that in both in public and private schools the majority of respondents reside within 3km from school (79% and 71% respectively). Private schools show a higher percentage than in public schools that reside more than 3 km from the school (29% vs. 20%).

Graph 5: Distance to school



Author (2022)

Influence of distance to school was analysed on the perceived levels of traffic and social safety across public and private schools.

To capture respondents' perceptions of traffic safety, five statements regarding the route to school were formulated (Appendix 2 – Table 3 – 3rd item) with the scale of response from 0 to 4 where 0= “Not sure”, 1= “Strongly disagree”, 2= “Disagree”, 3= “Agree” and 4= “Strongly agree”. These statements were based on the literature review regarding the characteristics of a safe traffic environment. To obtain a single measurement scale for the domain “perceived level of traffic safety”, the answers to the statements of each respondent were added together and compared to the maximum result possible to be obtained (20 in the case of traffic safety considering 5 statements with a maximum answer of 4). According to this, results were scored and classified as “Low”, “Mid” and “High” level of perceived traffic safety. A low level means a perceived poor traffic safety environment on the route to school and correspondingly for “Mid” and “High” levels. Results show that for both public and private schools, a high level of perceived traffic safety is least frequent for distances to school within 3km and more than 3km (Table 7). In private school no high perceived level of traffic safety was represented for school trips of more than 3km. A notable observation is that for distances to school of more than 3km, low level of perceived traffic safety is more frequent in private school (47%) than in public schools (17%).

Table 7: Perceived level of traffic safety by distance to school

Indicator	Public Schools (n=113)			Private Schools (n=65)		
	Low	Mid	High	Low	Mid	High
Distance to school	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Within 3km	32 (36%)	48 (54%)	9 (10%)	14 (30%)	28 (61%)	4 (9%)
> 3km	4 (17%)	16 (70%)	3 (13%)	9 (47%)	10 (53%)	-

Author (2022)

To evaluate the influence of distance on perceived level of traffic safety, correlations and chi-squared were applied between the two variables. The next hypothesis was assumed:

- Null hypothesis: $H_0= 0=$ There is no relationship between distance to school and perceived level of traffic safety.
- Alternative hypothesis: $H_a\neq 0$

Table 8: Correlations and p-value output between distance to school and perceived level of traffic safety

Indicators	Public Schools (n=113)		Private Schools (n=65)	
	Correlation	p-value (chi2)	Correlation	p-value (chi2)
Distance vs. Perceived level of traffic safety	0.0654	0.367	-0.2754	0.084

Author (2022)

P-value results indicate that for both public and private schools we fail to reject our null-hypothesis at 5% level and therefore at the 1% level. For the studied sample, there was not sufficient evidence to conclude that distance to school has an effect on the perceived level of traffic safety.

Similarly, the perception of social safety was aimed to be captured by statements based on situations related to crime (Appendix 2 – Table 3 – 4th item). The same scale 0-4 was used for each statement and the procedure to obtain a single measurement scale for the domain “perceived level of social safety” was followed for its scoring and classification as “Low”, “Mid” and “High”. A low level means a perceived poor social safety environment on the route to school and correspondingly for “Mid” and “High” levels. Interestingly, public school respondents who reside more than 3km from school presented most commonly a high level of perceived social safety than a low one, while in private schools no high level of perceived social safety was computed:

Table 9: Perceived level of social safety by distance to school

Indicator	Public Schools (n=113)			Private Schools (n=65)		
	Low	Mid	High	Low	Mid	High
Distance to school	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Within 3km	33 (37%)	37 (42%)	19 (21%)	14 (30%)	22 (48%)	10 (22%)
> 3km	3 (13%)	12 (52%)	8 (35%)	10 (53%)	9 (47%)	-

Author (2022)

To evaluate the influence of distance on perceived level of social safety, correlations and chi-square were applied between the two variables. The next hypothesis was assumed:

- Null hypothesis: $H_0= 0=$ There is no relationship between distance to school and perceived level of social safety.
- Alternative hypothesis: $H_a\neq 0$

Table 10: Correlations and p-value output between distance to school and perceived level of social safety

Indicators	Public Schools (n=113)		Private Schools (n=65)	
	Correlation	p-value (chi2)	Correlation	p-value (chi2)
Distance vs. Perceived level of traffic safety	0.0988	0.391	-0.3531	0.013**

Author (2022)

P-value outputs show that in private schools, we reject the null hypothesis at the 5% significance level, showing that for the sample analysed, distance to school influences the perceived level of social safety. Furthermore, they present a negative moderate correlation which implies that when the distance to school increases, the perceived level of social safety decreases. A respondent of the focus groups with private schools supports it:

“The school is far away but we would not take public transportation, the road is dangerous, there are robberies”. – Respondent of private schools

4.2.1.2 Street profile to school

To evaluate this factor as a single domain, statements related to the street profile (Appendix 2 – Table 3 – 2nd item) were given to respondents to rate them from 0-4. Then, similarly to the previous domains, a “perceived level of urban adequacy” was classified in “Low”, “Mid”; “High”. A low level means a perceived poor urban adequacy environment on the route to school and correspondingly for “Mid” and “High” levels.

To evaluate if there is an influence of distance on perceived level of traffic safety, correlations and chi-square were applied. The next hypothesis was assumed:

- Null hypothesis: $H_0 = 0$ There is no relationship between perceived level of urban adequacy and perceived level of traffic safety.
- Alternative hypothesis: $H_a \neq 0$

Table 11: Correlations and p-value output between perceived adequacy of urban form and perceived level of traffic safety

Indicators	Public Schools (n=113)		Private Schools (n=65)	
	Correlation	p-value (chi2)	Correlation	p-value (chi2)
Perceived adequacy of Urban Form vs. Perceived level of traffic safety	-0.0578	0.941	0.058	0.978

Author (2022)

- Null hypothesis: $H_0 = 0$ There is no relationship between perceived level of urban adequacy and perceived level of social safety.
- Alternative hypothesis: $H_a \neq 0$

Table 12: Correlations and p-value output between perceived adequacy of urban form and perceived level of social safety

Indicators	Public Schools (n=113)		Private Schools (n=65)	
	Correlation	p-value (chi2)	Correlation	p-value (chi2)
Perceived adequacy of Urban Form vs. Perceived level of traffic safety	-0.1280	0.638	0.0345	0.488

Author (2022)

P-value results indicate that for both public and private schools we fail to reject our null-hypothesis at 5% level that perceived level or urban adequacy has an effect on the perceived level of traffic safety. For the studied sample, there was not sufficient evidence to conclude their relationship and this result is related to one of the focus group extract of responses:

“The pavement of the street to school are broken and there are sidewalks but either they have holes or poles are in the way, I not easy get through, but we still walk to school because is only a few blocks away”. – Respondent 5

Similarly, p-value results show that for the studied sample, there was not sufficient evidence to conclude that the perceived level or urban adequacy has an effect on the perceived level of social safety in both public and private schools, so we fail to reject the null hypothesis at 5% significance level.

4.2.1.3 Past experiences

Considering that parents decide on their children’s commuting mode to school, their past experiences may likewise be part of this election. For this purpose, parents were asked if they, their family or friends have been part of a traffic crash or have been victims of a crime in the past. The next hypothesis was framed:

- Null hypothesis: $H_0= 0=$ There is no relationship between past traffic crash experiences as victims while walking or cycling and perceived level of traffic safety.
- Alternative hypothesis $H_a\neq 0$

Table 13: Correlations and p-value output between past traffic crash experience and perceived level of traffic safety

Indicators	Public Schools (n=113)		Private Schools (n=65)	
	Correlation	p value (chi2)	Correlation	p value (chi2)
Past traffic crash experience while walking or cycling vs. Perceived level of traffic safety	-0.0175	0.979	0.1982	0.107

Author (2022)

- Null hypothesis: $H_0= 0=$ There is no relationship between past crime experiences as victims while walking or cycling and perceived level of social safety.
- Alternative hypothesis: $H_a\neq 0$

Table 14: Correlations and p-value output between past traffic crash experience and perceived level of social safety

Indicators	Public Schools (n=113)		Private Schools (n=65)	
	Correlation	p-value (chi2)	Correlation	p-value (chi2)
Past traffic crime experience while walking or cycling vs. Perceived level of social safety	0.0989	0.057	0.2993	0.052**

Author (2022)

P-value results show that, for private schools, we can reject the null hypothesis at the 5% significance level, showing that for the sample analysed, past crime experiences while walking or cycling influence the perceived level of social safety. Furthermore, they present a positive moderate correlation which implies that in a positive response to being a victim of past crime experiences, the perceived level of social safety increases too. For the case of public schools, we can reject the null hypothesis at the 5% level that past crime experiences have an effect on the perceived level of traffic safety. Similarly with the relation between past traffic crash experiences and perceived level of traffic safety, where we can reject the null hypothesis at 5% level for both types of schools.

4.2.1.4 Cronbach’s reliability test

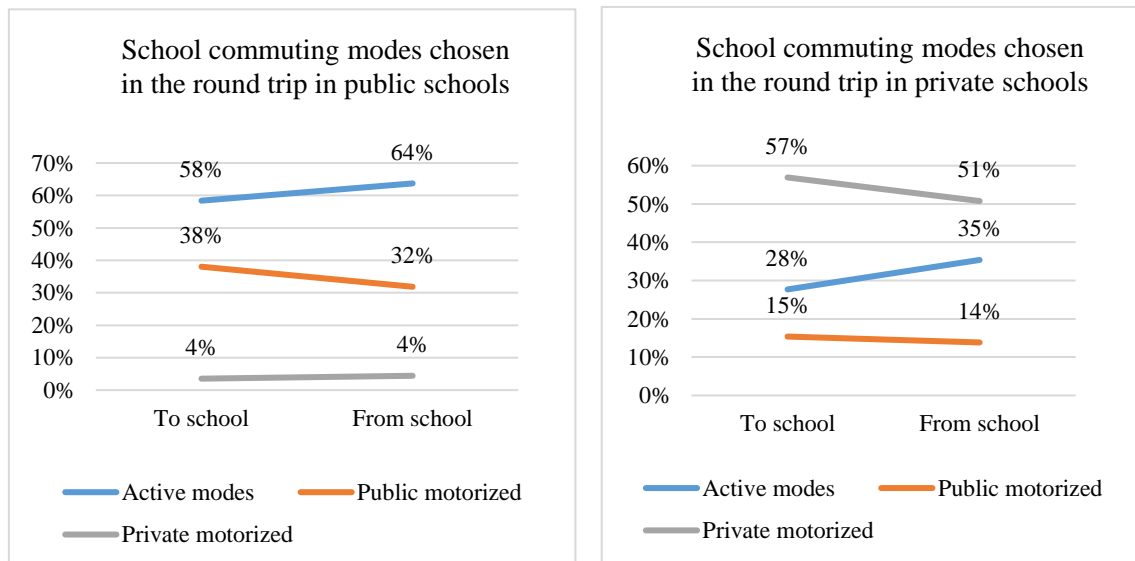
To compute cumulative perceptions, the Cronbach’s reliability test was applied on the indicators of urban form, perceived level of road safety and perceived level of social safety to test the internal consistency. A Cronbach’s alpha (α) value of 0.7557 was obtained between urban form and traffic safety indicators, and $\alpha=0.7365$ between urban form and social safety indicators. Therefore, results of the test were acceptable and reliable for the study.

4.3 Socioeconomic characteristics and commuting modes to school

4.3.1 Commuting modes to school

According to the questionnaire performed, it is observed that active modes increase for return trips among both types of schools, from 58% to 64% in public schools and 28% to 35% in private schools. In parallel, public motorized choice decreases among public school children for return trips while the same happens to private motorized choice in private schools.

Graph 6 and Graph 7: School commuting mode to and from school by type of school



Author (2022)

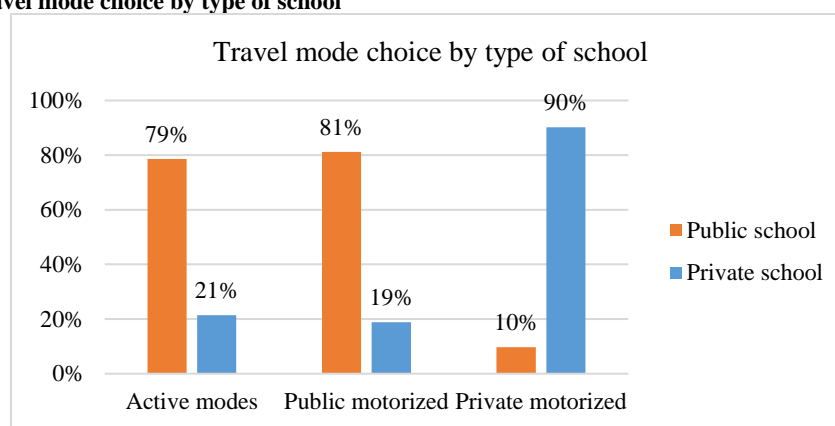
A respondent of focus groups gives an insight related to time convenience for this output:

“We live a few blocks from school but I have to go to work and my husband too, so we do not have time to take him to school. It is easier for me to send my child to school with my mother (his grandmother) using an app taxi. For returning home, I already have more time so I leave work, I can pick up my child and we go home walking since we are no longer in a hurry” - Respondent of private school

This study will continue by analysing the frequency of variables considering the commuting trips made from home to school as these are done during peak hours in Lima which contributes to traffic congestion in comparison to trips made from school that are undertaken during peak-off hours.

From the total of responses for each commuting mode, the percentage shared among public and private schools was obtained (Graph 8). Active modes represented 79% in public schools while 21% in private schools. For, public motorized modes, 81% and 19% correspond to public and private schools respectively while private motorized modes represented 10% and 90% are distributed among public and private schools respectively.

Graph 8: Travel mode choice by type of school



Author (2022)

4.3.2 Commuting mode to school by sociodemographic profile

Table 15 analyses the variable gender by type of school and children’s travel mode to school collected from the target population. It shows that in terms of gender, both female and male students commute more in active modes in public schools (55% and 61% respectively) than in private schools where both female and male students commute more by private motorized modes (48% and 62% respectively). The rest of child sociodemographic characteristics results can be found in Appendix 3.

Table 15: Sociodemographic characteristics by type of school and children’s travel mode to school

Indicator	Public Schools (n=113)				Private Schools (n=65)			
	Active modes	Public motorized	Private motorized	All	Active modes	Public motorized	Private motorized	All
Gender	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Female	31 (55%)	24 (43%)	1 (2%)	56 (69%)	7 (28%)	6 (24%)	12 (48%)	25 (31%)
Male	35 (61%)	19 (33%)	3 (6%)	57 (59%)	11 (28%)	4 (10%)	25 (62%)	40 (41%)

Author (2022)

4.3.3 Commuting mode to school by socioeconomic profile

Table 16 analyses the most relevant results of household socioeconomic characteristics stratified by type of school and children’s travel mode to school. The rest of child socioeconomic characteristics can be observed in Appendix 3.

It shows that in public schools, both students with low and mid household income are more likely to commute by active modes (58% and 60%) respectively while in private schools, students with low, mid and high monthly household income are more likely to commute in private motorized modes.

In terms of vehicle ownership, it is interesting to note that respondents from public schools who own a car are more likely to not decide on private modes for their children to commute to school while in private schools, students whose parents own a car commute more by private modes (73%). In this sense, despite not owning a car or motorcycle,

parents of private schools selected private motorized as a transport mode. Therefore, this result can be understood that private trips are provided by private services of school vans.

Table 16: Household socioeconomic characteristics by type of school and children’s travel mode to school

Indicator	Public Schools (n=113)				Private Schools (n=65)			
	Active modes	Public motorized	Private motorized	All	Active modes	Public motorized	Private motorized	All
Monthly household income	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Low	60 (58%)	40 (39%)	3 (3%)	103 (81%)	6 (25%)	6 (25%)	12 (50%)	24 (19%)
Mid	6 (60%)	3 (30%)	1 (10%)	10 (24%)	10 (32%)	3 (10%)	18 (58%)	31 (76%)
High	-	-	-	-	2 (20%)	1 (10%)	7 (70%)	10 (100%)
Car ownership								
Yes	7 (70%)	3 (30%)	-	10 (23%)	6 (19%)	3 (8%)	24 (73%)	33 (77%)
No	58 (59%)	39 (40%)	2 (1%)	99 (77%)	12 (40%)	7 (23%)	11 (37%)	30 (23%)
Can't say	1 (25%)	1 (25%)	2 (50%)	4 (67%)	-	-	2 (100%)	2 (33%)

Author (2022)

4.3.4 Attitudes towards sustainable mobility in mode choice

This domain was likewise analysed by scores and level of agreement with sustainable mobility aspects (Appendix 2- Table 3 – Item 5) as environmental consciousness, health consciousness, etc. A high level means that respondents agree with these aspects and so on for the other two levels. In Table 18 it can be appreciated that for the overall sample and for respondents who live within 3km from school in public schools, active modes are dominant regardless of their attitudes towards sustainable mobility. In private schools, active and private motorized modes are dominant for both cases.

Table 17: Attitudes towards sustainable mobility by type of school and children’s travel mode to school for distances from home within 3km

Indicator	Public Schools (n=89)				Private Schools (n=46)			
	Active modes	Public motorized	Private motorized	All	Active modes	Public motorized	Private motorized	All
Attitudes toward sustainable mobility								
Low	7 (70%)	3 (30%)	-	10 (11%)	2 (67%)	1 (33%)	-	3 (7%)
Mid	41 (72%)	13 (23%)	3 (5%)	57 (64%)	10 (35%)	4 (14%)	15 (51%)	29 (63%)
High	16 (73%)	5 (23%)	1 (4%)	22 (25%)	6 (43%)	3 (21%)	5 (36%)	14 (30%)

Author (2022)

To evaluate if there was an effect of the attitudes towards sustainable mobility in mode choice on the commuting mode to school, correlations and chi-square were applied among different groups of respondents. The next hypothesis was assumed:

- Null hypothesis: $H_0 = 0$ There is no relationship between attitudes towards sustainable mobility and commuting mode to school.
- Alternative hypothesis: $H_a \neq 0$

Table 18 shows the most relevant results, The complete correlations and p-value results can be found in Appendix 4 - Table 28.

Table 18: Correlations and p-value output between perceived adequacy of urban form and perceived level of social safety

Indicator	Actives modes		Public motorized modes		Private motorized modes	
	Correlation	p-value (chi2)	Correlation	p-value (chi2)	Correlation	p-value (chi2)
Private school respondents & Distance home - school is "walkable"	0.0508	0.584	-0.2817	0.036**	0.1499	0.752

Author (2022)

Results showed no relevant effect of social safety on the commuting mode to school, thus, we can fail to reject the null hypothesis at 5% significance level.

P-value results show that for the group of private schools' respondents who stated that the distance from home to school is "walkable", we can reject the null hypothesis at the 5% significance level, showing that for the sample analyzed, attitudes toward sustainable mobility influence the selection of public motorized modes. They present a negative weak correlation which implies that higher attitudes towards sustainable mobility decrease the selection of public motorized modes. In that sense, considering that this groups stated the distance "as walkable", this suggest that they would choose active modes fort their children to commute to school.

4.4 Perception on traffic and social safety and their influence on commuting modes to school decision

4.4.1 Exploring influences of perceived level of traffic safety on commuting mode to school

The domain "perceived level of traffic safety" was obtained based on respondents' answers to the five statements which were later classified into three levels: low, mid and high (see item 4.2.1.1). A low level of perceived traffic safety means that streets are seen as risky due to traffic and drivers' behaviours and so on for the other two levels. It can be observed in Table 19 that for the overall sample, the three levels of perceived traffic safety, the most common commuting mode in public schools are the active ones. In private schools, for low and mid-levels of perceived traffic safety, private motorized modes are the most common answer, while for a high perceived level of traffic safety, meaning that route to school is seen with no or low risk due to traffic, active modes are the most frequent answer. These results are similar for the sample of respondents who live at a distance less than 3km from school.

Table 19 : Perceived level of Traffic Safety by type of school and children’s travel mode to school

Indicator	Public Schools (n=113)				Private Schools (n=65)			
	Active modes	Public motorized	Private motorized	All	Active modes	Public motorized	Private motorized	All
Perceived level of traffic safety								
<u>Overall sample</u>								
Low	23 (64%)	10 (28%)	3(8%)	36 (32%)	4 (17%)	4 (17%)	15 (66%)	23 (35%)
Mid	35 (54%)	29 (45%)	1 (1%)	65 (58%)	11 (29%)	6 (16%)	21 (55%)	38 (58%)
High	8 (67%)	4 (33%)	-	12 (10%)	3 (75%)	-	1 (25%)	4 (7%)
<u>Distance to school within 3km</u>								
Low	23 (72%)	6 (19%)	3 (9%)	32 (36%)	4 (28%)	4 (18%)	6 (44%)	14 (30%)
Mid	34 (71%)	13 (27%)	1 (2%)	48 (54%)	11 (39%)	4 (14%)	13 (47%)	28 (61%)
High	7 (78%)	2 (12%)	-	9 (10%)	3 (75%)	-	1 (25%)	4 (9%)

Author (2022)

To evaluate the influence of perceived level of road safety on the commuting mode to school, correlations and chi-square were applied among different groups of respondents (Table 21). According to the results in the contingency tables, household income level is a relevant factor when looking at the commuting modes results. This variable was correlated with other socioeconomic variables (Appendix 4 – Table 29) showing a moderate to strong correlation with factors type of school and car ownership, therefore one of the groups for the current analysis considered income level as a cross cutting variable. The next hypothesis was assumed:

- Null hypothesis: $H_0 = 0$ There is no relationship between perceived level of road safety and commuting mode to school.
- Alternative hypothesis: $H_a \neq 0$

Table 20 shows the most relevant results. The complete correlations and p-value outputs can be found in Appendix 4 – Tables 30-33.

Table 20: Correlations and p-value (two-tailed) output between perceived level of road safety and commuting mode to school

	Actives modes		Public motorized modes		Private motorized modes	
	Correlation	p-value (chi2)	Correlation	p-value (chi2)	Correlation	p value (chi2)
Perceived level of traffic safety						
Overall sample	0.1594	0.014**	-0.0025	0.347	-0.1863	0.033**
Public school	0.094	0.18	-0.0165	0.131	-0.2073	0.047**
Mid & high-income households	0.2655	0.044**	0.0806	0.384	-0.3092	0.069*

Author (2022)

It can be observed that:

1. For the overall sample, we can reject the null hypothesis at 5% level that perceived level of traffic safety has no influence the selection of active and private motorized modes for the sample analysed. For both commuting modes, correlations are null or negligible which suggests that despite their level of perceived traffic safety (low, mid or high), respondents choose active modes and private motorized modes for their children to commute to school in a similar way.
2. For public school respondents of the sample, we can reject the null hypothesis under the 95% confidence level that perceived level of traffic safety has no influence the selection of private motorized modes. It is observed a weak correlation meaning that when increasing the perception level of traffic safety, which is perceiving safer and less risky streets due to traffic, public school respondents may be less likely to choose private motorized modes. However, this perception is not relevant enough to influence not choosing private motorized modes.
3. Respondents that belong to the mid and high-income group, p-value result in relation to actives modes allows to reject the null hypothesis at 5% significance level, showing that for this group, perceived level of road safety has an effect on the selection of actives modes to commute to school. They present a weak positive relationship meaning that when perceiving the route to school as safer and less risky due to traffic, they may tend to select active modes to school.
4. At a 90% confidence level, the perceived level of traffic safety of mid and high-income respondents shows a moderate negative relationship with private motorized modes. This suggests that when this group perceives the route to school as less risky due to traffic, private motorized modes are less likely to be selected for commuting to school.

These results are consistent with both focus group's answers:

"To get to school we do not have to cross big avenues and the streets on the route there is not much traffic, so for me walking is ok, I do not have much concern about traffic accidents there" – Respondent of public school)

"Traffic is chaotic in this city and more now that they are building one of the stations of the metro line close to the school. Before the pandemic, we went walking to school but now the construction makes the route longer and there is more traffic, so it is impossible to cross. Now I send my child with a private school van that takes her from the door of the house to the door of the school and vice versa". – Respondent of private school

4.4.2 Exploring influences of perceived level of social safety on commuting mode to school

Perceived level of social safety was analysed within type of schools and commuting modes to school. A low level of perceived social safety means that streets are seen as risky by parents due to crime, alleys and people around. According to Table 21 outputs, for public schools' respondents, active modes are dominant regardless of the level of perceived social safety with the exception of the mid-level which presents active and public motorized modes with similar shares. For private schools, private motorized modes are dominant for the three levels of perception. For respondents living within 3km of school, a mid-level of perception shows active modes as dominant in public schools.

Table 21 : Perceived level of Social Safety by type of school and children’s travel mode to school

Indicator	Public Schools (n=113)				Private Schools (n=65)			
	Active modes	Public motorized	Private motorized	All	Active modes	Public motorized	Private motorized	All
Perceived level of social safety								
<u>Overall sample</u>								
Low	25 (69%)	10 (28%)	1 (3%)	36 (32%)	6 (25%)	3 (13%)	15 (62%)	24 (31%)
Mid	24 (48%)	23 (46%)	3 (6%)	50 (44%)	9 (29%)	5 (16%)	17 (55%)	31 (34%)
High	17 (63%)	10 (37%)	-	27 (26%)	3 (30%)	2 (20%)	5 (50%)	10 (35%)
<u>Distance to school within 3km</u>								
Low	25 (76%)	7 (21%)	1 (3%)	33 (37%)	6 (43%)	2 (14%)	6 (43%)	14 (30%)
Mid	24 (65%)	10 (27%)	3 (8%)	37 (42%)	9 (41%)	4 (18%)	9 (41%)	22 (48%)
High	15 (79%)	4 (21%)	-	19 (21%)	3 (30%)	2 (20%)	5 (50%)	10 (22%)

Author (2022)

To evaluate if there was an effect of perceived level of social safety on the commuting mode to school, correlations and chi-square were applied among different groups. The next hypothesis was assumed:

- Null hypothesis: $H_0 = 0$ = There is no relationship between perceived level of road safety and commuting mode to school.
- Alternative hypothesis: $H_a \neq 0$

The complete correlations and p-value results can be found in Appendix 4. Results showed no relevant effect of social safety on the commuting mode to school in any of the groups analysed; thus, we can fail to reject the null hypothesis at 5% significance level for the sample studied.

4.5 Interpretation of results

According to descriptive statistical analysis, the main results did not behave completely as expected. Based on the conceptual framework of this study which is adapted from McMillan’s one (2015), perceptions on safety regarding sustainable mobility were expected to have a relevant participation in the decision parents take regarding the commuting mode to school of their children. Nevertheless, outcomes show that this premise is slightly fulfilled in certain groups of respondents, especially when they are divided by income level.

Socio-economic characteristics show that for the sample of respondents analysed, there are no children from the high-income level enrolled in public schools and 24% of the mid-income level are enrolled in them. Additionally, 81% of the low-income group depend on public schools. This distribution shows the importance of the relationship between household income level and type of school, suggesting that low-income groups are more likely to enrol their children in public schools and mid/high-income levels in private schools.

Distance and urban form did not show a priority on the level of perceived traffic and social safety in both type of school respondents, suggesting that children commuting mode is selected regardless of the conditions of the urban infrastructure

In private schools, parents are more likely to decide for private motorized modes for their children to commute to school (56%). According to Graph 5 and Graph 8, private schools opting for private motorized transport is related to a larger proportion sending children to schools that exceed 3 km from the place of residence. An extract of the interviews administered provides greater context and consistency to these results:

“Low-income areas in Lima are associated with more crime and less traffic infrastructure provision. Children usually live close to the school so, they commute with a caregiver by walking or in a mototaxi (three-wheeler), but the conditions are poor, I refer to crime, pollution and lack of road infrastructure. Improving the built environment is expensive, and authorities usually do not have the budget for it. The story for private schools is different. In some private schools, children usually live close so they commute by walking, but in the most expensive private schools of Lima, is not usual to see children walking around, maybe because they usually live far. They are always on a private van, on the school bus or in the private family car” – Interviewee (urban form practitioner)

Regarding traffic safety perceptions, the most accurate results were given for the mid/high-income group, who shows priority for traffic safety for selecting active mode and has a negative association with the private motorized mode while in low-income groups no association was found. These results suggest that, even though parents are aware of the safety of their children when they mobilize to school, the final decision regarding the mode of transport is stronger influenced by the household income level. This outcome is consistent with the responses of both focus groups:

“I would send my children to school in a private van, but money is not enough to pay for it. Anyway, we live close, so we have to wake up earlier, so I have time to take my son to school and then commute to work” – Respondent of public school

“Yes, I have to pay the app taxi daily, but I work for that. Of course, I am worried about the traffic accidents and crimes around, but for example, in the car, my child is safer than walking”. - Respondent of private school

Focus groups also showed that children that are part of the sample (1-4th grade of elementary school) commute with a caregiver either by active, public or private motorized modes. From this, it can be inferred that, although there are concerns regarding traffic and social safety for the three modes of transport to school, these do not condition parents to select the transport mode as they or other caregivers will accompany children to school:

“There are dangers on the street due to traffic and crime, but I accompany my son and when we walk, I teach him the route, which streets to avoid and how to cross the traffic” - Respondent of public school

“Of course, I think about my child’s safety from the moment she gets into the van, but as she is inside of it and the lady who drives is very responsible, I trust in her” - Respondent of private school

Based on the study findings, the applicability of the conceptual framework was less accurate than expected for the sample studied. Even though respondents develop perceptions of traffic and social safety of the mobility to school, these are not the main drivers for the final decision of the transport mode as the framework proposes. This study has identified other variable related to income that would be more relevant and valid to apply for a more precise prediction of the commuting mode to school in Lima and other metropolitan cities in Peru.

Chapter 5: Conclusions

This study was based on the premise that parental perceptions of safety regarding sustainable mobility were factors that influence the commuting mode selection to school based on parents' decisions.

5.2 Answer to the research questions

Research question

Whether and to what extent do parental safety perceptions on urban mobility influence the decision on their children's commuting mode to school?

The main hypothesis of this research based on the conceptual framework was that parental safety perceptions on urban mobility had an effect on the decision of their children's commuting mode to school.

The research suggests that mid-high income groups' perceptions of traffic safety have a moderate effect on their children's school travel mode choice. Higher perceptions of traffic safety, which means perceptions of a safer traffic environment on the journey to school, make them less likely to select private motorized modes and more likely to select active modes. In low-income groups, traffic safety perceptions were not found as drivers for deciding on commuting mode to school.

Perceived social safety was not found relevant to predict the selection of commuting modes to school in neither of the two types of schools. These results be aligned to Muthuri et.al (2016) outputs, who did not find associations between the perception of crime and active commuting. The relation between the social safety variable and its effect on active commuting may be highly dependent on the area and context of study, which for the case of Lima could be found more related in areas with higher levels of criminality.

The study further suggests that parents do perceive and have an opinion regarding traffic and social safety, but they do not play a relevant role in the final decision on the transport mode to school, especially for the group of low-income respondents.

Sub-research questions

1. Which factors influence parental perceptions of social and traffic safety in relation to their children's commute to and from school?

The hypothesis for this study was those elements as urban form (distance to school and street profile) and past experiences (traffic crashes and crime situations) shaped the perceptions on traffic and social safety in relation to children's mobility to school.

For respondents of public schools, distance and perceived level of urban adequacy did not show effect on the perceived levels of traffic or social safety.

In private schools, the perceived level of traffic safety was not associated by the adequacy of the street profile neither by the distance to school. On the other hand, while distance to school increases and respondents had past crime experiences while walking or cycling, their perceived level of social safety decreases.

2. Which factors other than parental safety perceptions play a role in their decision-making regarding the mode of commuting of children to and from school?

It can be observed that in Lima, academic recognition is important among mid-high-income groups, so they send their children to schools that are further than 3km. In this group, distance was found to be a more determinant factor for selecting the commuting mode which is align to the literature review insight regarding the relevance of distance to school as one of the main factors for trips of more than 3km.

As discussed previously, for this study income level have been found a prevalent factor in the decision of the commuting mode to school. This output is consistent with a study conducted in Lima on school segregation, Cuenca (2013) concludes that the public education offer presents a tendency to be covered by the poorest groups in the city. Likewise, according to McMillan et al. (2005), families with lower socioeconomic levels are less likely to utilize a car, possibly due to lower ownership rates.

3. What implications do parental perceptions and their decision-making regarding children's commuting mode to and from school have for sustainable urban mobility?

According to the study, respondents were aware of the benefits of sustainable mobility, however, statistical results showed that these attitudes does not associate with the selection of the commuting mode.

The prevalence of a child transportation model based on the income level of families could increase social inequalities and generate a dependence on private motorized modes in private school students. Thus, while growing up, they could develop a positive attitude towards daily car (Motta Queiroz, Celeste, and Moura, 2020), to the detriment of sustainable mobility in Lima.

5.3 Societal and scientific contribution of this study

Traditional models of travel behaviour are generally restricted to the analysis of adult travel behaviour. This research is a first attempt to explore and identify which factors influence the election of transport commuting modes to school in a developing context as the city of Lima.

That subjective factors as perception should be part of the

The study has further brought to light the importance of the social environment referred to household income level in Lima and its relevant participation in commuting modes to school selection.

5.3 Practical implications of this study

Even though there is a strong link between safety perceptions regarding urban mobility on the selection of the commuting modes to school, it should be noted that the improvement of conditions of the urban form should not be neglected to subsequently improve the conditions for walking and cycling. The relevance between aspects of the urban form and safety from crime and/or traffic risk has been demonstrated by previous studies (Kweon et al., 2021, Mehdizadeh et al., 2017, Shutt et al.,2007).

Likewise, this study suggests that improving traffic safety may decrease the selection of private modes and increase active modes to commute to school among mid-high-income groups in Lima. Although this result was found in the mid-high-income group, it should

be noted that improving traffic safety must be an initiative across all levels of society in Lima. This is also reflected in the focus group responses, where parents indicate that they would like to see improvements in sidewalks, road safety and safety on the route to school. First, to reduce the consequences of traffic crashes, and as this study suggest, begin to make change for more sustainable modes of transportation to commute to school.

As a result, initiatives for promoting walking for the needs of all groups, in this case, children, should be designed and aimed at improving neighbourhood traffic safety and consequently, develop a more sustainable mobility in Lima.

5.2 Practical limitations and suggestions for further research

Considering that the data for this study was only gathered in one district of the city of Lima, there is a constraint on generalizing the research's findings to all the city or other similar cities. As Breña is classified middle income district (INEI, 2021), other areas of Lima with different levels of income classification may lead to different results. Nevertheless, the results can be used to propose theoretical approaches in similar scenarios.

For the sample studied, the type of school has been found to be strongly correlated to the household level of income. This could be related to the given socio-economic disparities in admission and accessibility to public and private schools in Lima (Cuenca, 2013) which found to be supported by focus groups answers:

“Because of the pandemic, we move far away but this school is recognized so we decided our kid to keep studying here. Of course, I cannot afford a private school van, so we commute daily by train and then we walk. We do the same to return home. This school is good and recommended. In my case I could not find a good school around where I live now or the vacancies of good schools ended” - Respondent of public school

Considering the disparities of social development in Lima and other metropolitan cities of Peru, further research could propose a modified conceptual framework that considers income level as the independent variable for predicting the commuting mode to school.

The research also raises the question of policy and planning in shaping urban development and adequate education availability. How decisions regarding where education facilities are implemented and managed can bring new practical insights considering that sustainable mobility goes hand in hand with urban development.

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Appendix 1: Research instruments

Questionnaire for parents (English)

Dear Madam/Sir,

My name is Jessica Huaylinos and I am registered as a student at the MSc. Program in Urban Management and Development at the Erasmus University of Rotterdam in The Netherlands. As a final requirement to complete the program, I am developing my thesis in the city of Lima. My research is about the factors that influence parents' decisions regarding their elementary school-aged children's (1st to 4th grade) commuting mode to and from school and as part of it, this questionnaire aims to acquire information regarding your traffic and social safety perceptions on your child's mobility to school. The results of this study will be shared with Lima, Breña, and La Victoria municipalities, so your answers have an important role in the improvement of safety in the mobility of children to school. Your household has been randomly selected to fill out this questionnaire. I ask please any of the parents or caregivers to fill it out. If you have more than one child between the ages of 6-10, please fill it for only one of them.

This is an anonymous questionnaire; your name won't be required to fill in any part. The obtained information will be confidential and used for academic purposes only.

The filling of the questionnaire is designed to last 10 minutes.

In case of any doubts, please contact me by mail at 628068jh@eur.nl or you can call me at the number 987792329.

Thank you very much for your time and cooperation.

Check:

1. Name of child's school

- La Salle Lima
- República de Uruguay
- Olaya
- San Benito

2. Age of your child

- 6 years
- 7 years
- 8 years
- 9 years
- 10 years

3. School grade of your child

- 1st grade
- 2nd grade
- 3th grade
- 4th grade

4. Gender of your child

- Female
- Male

5. District of residence: _____

6. What is the distance between home and school?

- Less than 1 km 2 km – 3 km I don't know
 1 km– 2 km More than 3 km

7. The school is located within a walkable distance

- Yes No I don't know

8. The school is located within a cycling distance

- Yes No I don't know

9. How does your child commute to school?

- Only walking
 Only cycling
 In public transportation (bus, combi, micro, Metropolitano, train)
 School van (ride-sharing)
 Mototaxi (three-wheelers)
 Motorcycle
 Taxi / App taxi
 Own car

10. How does your child go back from school to home?

- Only walking
 Only cycling
 In public transportation (bus, combi, micro, Metropolitano, train)
 School van (ride-sharing)
 Mototaxi (three-wheelers)
 Motorcycle
 Taxi / App taxi
 Own car

11. In questions 9 and 10 you have chosen one of the following modes: only walking, only cycling, public transportation, school van, mototaxi, motorcycle, or taxi. Please, rate the degree of importance of each of the next 9 factors in deciding the mode of transport for your child to and from school by choosing one of the next 5 options:

	0 Not sure	1 Not important	2 Less important	3 Important	4 Very important
11.1 Distance to school					
11.2 Cost of transportation					
11.3 Comfort					
11.4 Security (crime rate)					

11.5 Traffic safety (traffic accidents)					
11.6 Weather					
11.7 Time convenience					
11.8 Because other parents do it as well					
11.9 It is my only option					

12. Based on your experience of facilities to walk between home and your elementary child's school, given below are statements that facilitate walking through the street in your neighborhood to your child's school. Please, indicate to what extent you agree with each statement by choosing one of the next 5 options:

	0 Not sure	1 Strongly disagree	2 Disagree	3 Agree	4 Strongly agree
12.1 There are sidewalks on most of the distance from home to school					
12.2 The sidewalks are wide enough to walk with my child					
12.3 The sidewalks are well maintained (paved and not cracks)					
12.4 The sidewalks are separated from traffic by parked cars or a grass/dirt strip					
12.5 There are pedestrian ramps on the sidewalks					
12.6 There are pedestrian or bicycle trails from home to school					

13. Based on your experiences about traffic safety and personal security on traffic between home and your elementary child's school, given below there are statements about traffic and crime security Please, indicate to what extent you agree with each statement by choosing one of the next 5 options:

	0 Not sure	1 Strongly disagree	2 Disagree	3 Agree	4 Strongly agree
13.1 There is so much traffic along the way from home to school that it makes it difficult or unpleasant to walk or cycle					
13.2 The speed of traffic on the route from home to school is usually slow (30 kph or less).					
13.3 On the route from home to school drivers respect the pedestrian crossings					
13.4 On the route to school, there are locations of potential traffic crashes type pedestrian impacts					
13.5 On the route to school, drivers are imprudent or exceed the speed limits					
13.6 There is a high crime rate along the route from home to school					
13.7 On the route to school, there are locations of potential crime situations					

13.8 There are alleys along the route to school that make it unsafe to walk or cycle					
13.9 There are dangerous people along the route to school that make it unsafe to walk or cycle					

14. Based on your own or family and friend’s experiences with traffic crashes and crime situations, please check one of the next 3 answers for each of the following questions:

	Yes	No	Can’t say
14.1 Have you ever been a victim of a traffic crash as a pedestrian or cyclist?			
14.2 Has any members of your family ever been victims of a traffic crash as pedestrians or cyclists?			
14.3 Have any of your friends ever been victims of a traffic crash as pedestrians or cyclists?			
14.4 Have you ever been a victim of a crime (robbery or assault) when walking or cycling?			
14.5 Have any members of your family ever been victims of a crime (rob or assault) when walking?			
14.6 Have any of your friends ever been victims of a crime (rob or assault) when walking?			

15. By choosing one of the next 5 options, to what extent do you agree or disagree with each of the next statements?

	0 Not sure	1 Strongly disagree	2 Disagree	3 Agree	4 Strongly agree
15.1 Traffic emissions are a threat to the environment.					
15.2 A car provides status and prestige.					
15.3 More cars on the traffic means more traffic crashes.					
15.4 If more people walked and cycled, this would be beneficial to our environment					
15.5 I just can’t imagine my life without a car					
15.6 Walking and cycling help me to be healthy.					
15.7 Parking in downtown should be restricted.					
15.8 Pedestrian streets create more traffic.					
15.9 Authorities should build more cycle lines In my neighborhood.					
15.10 Cycling is an excellent way for moving easily and efficiently in my neighborhood					
15.11 Moving in my neighborhood is more convenient by walking or cycling.					

16. Your household income per month is:

- Less than S/.1300 S/. 2480-3970 More than S/.
7020
- S/. 1300-2480 S/.3970-7020

17. What do you do for a living?

- Paid full-time work Only a homemaker
- Paid part-time work Other

18. Does your household own one or more cars?

- Yes No Can't say

19. Does your household own one or more motorcycles?

- Yes No Can't say

20. Does your household own one or more bicycles?

- Yes No Can't say

21. How many members of your family possess a driver's license? (Enter a number):

- Only one No one
- More than one Can't say

22. What is your highest education level?

- Complete elementary school
- Complete secondary school
- Technical
- University
- Other
- Can't say

Questionnaire for parents (Spanish)

Estimado(a) Señor(a),

Mi nombre es Jessica Huaylinos y estoy registrada como estudiante en la Maestría de Gestión y Desarrollo Urbano en la Universidad Erasmus de Rotterdam en Holanda. Como requisito final para culminar el programa, estoy desarrollando mi tesis en la ciudad de Lima. Mi investigación trata sobre los factores que influyen en las decisiones de los padres/cuidadores sobre el modo de transporte de sus hijos escolares de 1ro a 4to de primaria hacia y desde el colegio y, como parte de ella, este cuestionario tiene como objetivo adquirir información sobre sus percepciones de tráfico y seguridad ciudadana en la movilidad de su hijo/a al colegio. Los resultados de este estudio brindarán mayor información sobre la movilidad infantil en Breña y Lima a fin de promover movilidades más sostenibles y seguras para los escolares, por lo que sus respuestas tienen un papel importante en dicho objetivo. Pido por favor a alguno de los padres o encargados del escolar de llenarlo. En caso de tener más de un hijo/a matriculado/a entre 1ro-4to de primaria, llenar solo para uno de ellos.

Este es un cuestionario anónimo y no se requerirá su nombre o contacto en ninguna parte del mismo. La información obtenida será confidencial y utilizada únicamente con fines académicos.

El cuestionario está compuesto por preguntas de opción múltiple con una sola respuesta y está diseñado para durar aproximadamente 10 minutos, agradezco por favor responder todas las preguntas. En caso de cualquier duda, por favor ponerse en contacto con mi persona al correo 628068jh@eur.nl o al número celular 987792329.

¡Muchas gracias por su tiempo y cooperación!

Marque:

1. Edad de su hijo/a

- 6 años 7 años 8 años 9 años 10 años

2. Grado de primaria al cual asiste su hijo/a:

- 1er grado 3er grado
 2do grado 4to grado

3. Género de su hijo/a

- Femenino Masculino

4. Distrito de residencia (escribir): _____

5. ¿Cuál es la distancia entre su hogar y el colegio?

- Menor a 1 km Más de 3 km
 1 km– 2 km No lo sé
 2 km – 3 km

6. ¿Considera que el colegio está localizado a una distancia caminable desde su hogar?

- Sí No No lo sé

7. ¿Considera que el colegio está localizado a una distancia que se puede cubrir manejando bicicleta desde su hogar?

- Sí No No lo sé

8. ¿Qué modo de transporte usa su hijo/a para ir de su hogar al colegio?

- Solo caminando
 Solo en bicicleta
 En transporte público (bus, combi, micro, Metropolitano, Tren Eléctrico)
 Movilidad escolar
 Mototaxi
 Motocicleta
 Taxi / Taxi por aplicativo
 Auto propio

9. ¿Qué modo de transporte usa su hijo/a para regresar del colegio a su hogar?

- Solo caminando
 Solo en bicicleta
 En transporte público (bus, combi, micro, Metropolitano, Tren Eléctrico)
 Movilidad escolar
 Mototaxi
 Motocicleta
 Taxi / Taxi por aplicativo
 Auto propio

10. En las preguntas 8 y 9 usted ha elegido el modo de transporte de su hijo/a hacia y desde el colegio: *solo caminando, solo en bicicleta, transporte público, movilidad escolar, mototaxi, motocicleta o taxi*. Nos gustaría entender qué factores (enumerados en la tabla a continuación) considera importantes al decidir cómo su hijo/a viaja hacia y desde el colegio. Marque el grado de importancia para cada uno de los siguientes nueve factores eligiendo una de las cinco opciones de respuesta:

	0 No estoy Seguro/a	1 No importante	2 Menos importante	3 Importante	4 Muy importante
10.1 Distancia al colegio					
10.2 Costo de transporte					
10.3 Comfort					
10.4 Seguridad ciudadana (tasa de crimen)					
10.5 Seguridad vial (accidentes de tránsito)					
10.6 Clima					
10.7 Conveniencia por tiempo					
10.8 Porque otros padres también lo eligen					
10.9 Es mi única opción					

11. A continuación, se presentan afirmaciones relacionadas con su experiencia en el uso de las instalaciones existentes para caminar entre su hogar y el colegio de su hijo/a. Por favor marque qué tan de acuerdo se encuentra con cada una de las siguientes seis afirmaciones eligiendo una de las cinco opciones de respuesta:

	0 No estoy Seguro/a	1 Muy en desacuerdo	2 En desacuerdo	3 De acuerdo	4 Muy de acuerdo
11.1 Hay veredas en la mayor parte de la ruta al colegio					
11.2 Las veredas en la ruta al colegio son lo suficientemente anchas para caminar con mi hijo/a					
11.3 Las veredas en la ruta al colegio se encuentran bien mantenidas (pavimentadas y sin huecos)					
11.4 Las veredas en la ruta al colegio están separadas de la pista por una fila de vehículos estacionados o una franja de jardín/tierra					
11.5 Hay rampas peatonales en las veredas de la ruta al colegio					
11.6 Hay senderos peatonales o por donde manejar bicicleta en la ruta al colegio					

12. A continuación, se presentan afirmaciones relacionadas con sus experiencias de tráfico, seguridad vial y seguridad ciudadana en la ruta que conecta su hogar y el colegio de su hijo/a. Por favor marque qué tan de acuerdo se encuentra con cada una de las siguientes nueve afirmaciones eligiendo una de las cinco opciones de respuesta:

	0 No estoy seguro/a	1 Muy en desacuerdo	2 En desacuerdo	3 De acuerdo	4 Muy de acuerdo
12.1 Hay mucho tráfico en la ruta al colegio que hace difícil o inseguro caminar o manejar bicicleta					
12.2 La velocidad de los vehículos en la ruta al colegio es usualmente baja (30km/h o menor)					
12.3 En la ruta al colegio los conductores respetan los cruceos peatonales					
12.4 En la ruta al colegio hay lugares donde pueden ocurrir accidentes de tránsito tipo atropello					
12.5 En la ruta al colegio los conductores son imprudentes o exceden el límite de velocidad					
12.6 Hay una alta tasa de criminalidad en la ruta al colegio					

12.7 En la ruta al colegio hay lugares donde pueden ocurrir robos o asaltos					
12.8 Hay callejones en la ruta al colegio que lo hacen inseguro caminar o manejar bicicleta					
12.9 Hay gente de mal vivir en la ruta al colegio que lo hace inseguro caminar o manejar bicicleta					

13. Basándose en su propia experiencia en la calle o la de familiares y amigos, responda las siguientes preguntas marcando en una de las tres opciones de respuesta:

	1 Sí	2 No	3 No podría decir
13.1 ¿Alguna vez usted ha sido víctima de un accidente de tránsito como peatón o ciclista?			
13.2 ¿Alguna vez algún miembro de su familia ha sido víctima de un accidente de tránsito como peatón o ciclista?			
13.3 ¿Alguna vez algún amigo/a suyo/a ha sido víctima de un accidente de tránsito como peatón o ciclista?			
13.4 ¿Alguna vez usted ha sido víctima de un robo o asalto cuando se encontraba caminando o manejando bicicleta?			
13.5 ¿Alguna vez algún miembro de su familia ha sido víctima de un robo o asalto cuando se encontraba caminando o manejando bicicleta?			
13.6 ¿Alguna vez algún amigo/a suyo/a ha sido víctima de un robo o asalto cuando se encontraba caminando o manejando bicicleta?			

14. A continuación, se presentan afirmaciones relacionadas con el tráfico y el transporte en las ciudades. Por favor, marque qué tan de acuerdo se encuentra con cada una de las siguientes once afirmaciones eligiendo una de las cinco opciones de respuesta:

	0 No estoy Seguro/a	1 Muy en desacuerdo	2 En desacuerdo	3 De acuerdo	4 Muy de acuerdo
14.1 Las emisiones de los vehículos son una amenaza para el medio ambiente					
14.2 Un auto brinda status y prestigio.					
14.3 Más autos en las vías significan más accidentes de tránsito.					
14.4 Si más gente caminara o manejara bicicleta, esto sería beneficioso para el medio ambiente.					
14.5 Caminar es una excelente forma de moverse por mi vecindario de manera fácil y eficiente.					
14.6 Caminar o manejar bicicleta me mantiene saludable.					
14.7 Estacionar autos en el centro de la ciudad debería restringirse.					
14.8 Las calles que son solo peatonales generan más tráfico.					
14.9 Las autoridades deberían construir más ciclovías en mi vecindario.					
14.10 Usar la bicicleta es una excelente forma de moverse por mi vecindario de manera fácil y eficiente.					
14.11 Trasladarse en auto en mi vecindario es más conveniente caminando o manejando bicicleta por el tiempo.					

15. Su edad es:

- hasta 30 años
 41 a 50 años
 31 a 40 años
 Más de 51 años

16. Su relación con el/la escolar:

- Madre
 Hermano/a mayor
 Padre
 Guardián

17. ¿Cuál es el ingreso mensual en su hogar?_

- Menor a 1300 soles
 2480-3970 soles

 1300-2480 soles
 3970-7020 soles
 Mayor a 7020 soles

18. ¿A qué se dedica?

- Trabajo pagado a tiempo completo
 A la casa
 Trabajo pagado de medio tiempo
 Otro

19. ¿Posee en el hogar uno o más autos?

- Sí No No podría decir

20. ¿Posee en el hogar una o más motocicletas?

- Sí No No podría decir

21. ¿Posee en el hogar una o más bicicletas?

- Sí
 No
 No podría decir

22. ¿Cuántos miembros de su familia posee licencia de conducir?

- Solo uno
 Más de uno
 Ninguno
 No podría decir

23. ¿Cuál es su nivel educativo más alto?

- Primaria completa
 Secundaria completa
 Técnico
 Universitario
 Otro

24. ¿Cuántos miembros de su familia posee licencia de conducir?

- Solo uno
 Más de uno
 Ninguno
 No podría decir

25. ¿Cuál es su nivel educativo más alto?

- Primaria completa
 Secundaria completa
 Técnico
 Universitario
 Otro

Focus Group Guide (English)

Good morning,

First of all, I would like to thank you for your participation in this focus group discussion. My name is Jessica Huaylinos and I am a master's student from Erasmus University Rotterdam in The Netherlands. I am currently developing a thesis research about traffic and social safety perceptions from parents' views regarding their children's commuting mode to school in Lima. The reason for having this discussion is to find out your opinions and views as parents regarding this topic. The discussion will be divided into two parts. In the first part, we will discuss the topic in general with open questions that I will raise. In the second part, we will develop a map with your motives and priorities when selecting the mode of transport for your children to school. The discussion will take 1 hour. Before we start, I will also introduce the ground rules of this discussion:

- I would like everyone to participate and talk during the discussion.
- There are no right or wrong answers, we all have different perceptions and opinions.
- Your responses/answers will be recorded and are confidential and anonymous. They will be used for academic purposes only.
- I may interrupt some of you during the discussion to align the topic and focus on the research.
- Before we start, do you have any questions?

Part 1

Ice break part: presentation of each one and answering the question – what is your favorite sport why?

The researcher asked the next questions:

- What are the main criteria for choosing a particular school for your child/children? – is the distance between the home and school one of the criteria?
- What - in terms of km - according to you is walkable distance and cycling distance?
- In what mode of transport does your child commute to school? Why - Can you please state the reasons for choosing this particular mode of transport?
- What modes of transport do you use for commuting to (i) work, (ii) for daily grocery shopping, (iii) entertainment such as cinema, visiting the mall etc.?
- What according to you are the reasons why parents use personal motorized transport even though the school is located at a walkable/cycling distance?
- What thoughts are on top of your mind when your children are traveling to and from school?
- How do you understand/ what meaning do you attribute to the term safety in the context of your children's commute to school?
- What do you think are the advantages/disadvantages of walking/cycling?
- What do you think are the advantages/disadvantages of driving?

Part 2

The researcher shared pens and post-its and asked the participants to answer the next questions and put them on a map:

- Write 1 motive of why you selected this school for your children.
- If you wouldn't have to worry about anything (safety, cost, time, distance), write in which mode of transport would you like your children to commute to school?
- List 3 things that you would change or improve on the route to school that would make your children walk to cycle.

Conclusion and remarks

Focus Group Guide (Spanish)

Introducción

Buenos días,

En primer lugar, me gustaría agradecerle su participación en esta discusión. Mi nombre es Jessica Huaylinos y soy estudiante de maestría de la Universidad Erasmus de Róterdam en Holanda. Actualmente estoy desarrollando mi tesis de maestría sobre las percepciones de tráfico y seguridad ciudadana desde la perspectiva de los padres sobre el modo de transporte de sus hijos a la escuela en Lima. La razón de tener esta discusión es conocer sus opiniones y puntos de vista como padres con respecto a este tema. La discusión se dividirá en dos partes. En la primera parte hablaremos del tema en general con preguntas abiertas que iré planteando. En la segunda parte, elaboraremos un mapa con tus motivos y prioridades a la hora de seleccionar el modo de transporte de tus hijos al colegio. La discusión durará 1 hora. Antes de comenzar, también presentaré las reglas básicas de esta discusión:

- Me gustaría que todos participen y halen durante la discusión.
- No hay respuestas correctas o incorrectas, todos tenemos percepciones y opiniones diferentes.
- Sus respuestas serán grabadas y son confidenciales y anónimas. Se utilizarán únicamente con fines académicos.
- Puedo interrumpir a algunos de ustedes durante la discusión para alinear el tema y enfocarme en la investigación.
- Antes de comenzar, ¿tienen alguna pregunta?

Parte 1

Parte de rompehielos: presentación de cada uno y respuesta a la pregunta ¿cuál es tu deporte favorito por qué?

El investigador hizo las siguientes preguntas:

- ¿Cuáles son los principales criterios para elegir una escuela en particular para su hijo/hijos? – ¿La distancia entre el hogar y la escuela es uno de los criterios?
- ¿Para usted hasta cuando kilómetros considera es una distancia caminable y la distancia en bicicleta?
- ¿En qué modo de transporte viaja su hijo a la escuela? ¿Por qué? - ¿Puede indicar las razones para elegir este modo de transporte en particular?
- ¿Qué medios de transporte utiliza para ir al (i) trabajo, (ii) para las compras diarias de comestibles, (iii) entretenimiento como el cine, visitar el centro comercial, etc.?
¿Cuáles son, según usted, las razones por las que los padres utilizan el auto a pesar de que la escuela se encuentra a una distancia caminable/ciclista?
- ¿Qué pensamientos rondan por su mente cuando sus hijos van y vienen de la escuela?
- ¿Cómo entiende/qué significado le atribuye al término “seguridad” en el contexto del viaje de sus hijos a la escuela?
- ¿Cuáles cree que son las ventajas/desventajas de caminar/andar en bicicleta?
- ¿Cuáles cree que son las ventajas/desventajas de conducir?

Parte 2

El investigador compartió bolígrafos y post-its y pidió a los participantes que respondieran las siguientes preguntas y las pusieran en un mapa:

- Escriba 1 motivo de por qué eligió esta escuela para sus hijos.
- Si no tuviera que preocuparse por nada (seguridad, costo, tiempo, distancia), escriba en qué medio de transporte le gustaría que sus hijos viajaran a la escuela.
- Haga una lista de 3 cosas que cambiaría o mejoraría en la ruta a la escuela que harían que sus hijos caminen a andar en bicicleta.

Conclusión

Semi-Structured Interview Guide – Urban Mobility

Introduction of the interviewer

Good morning/ good afternoon, thank you for finding time for this interview. My name is Jessica Huaylinos and I am a student in the Urban Development and Management master's program at Erasmus University in Rotterdam, The Netherlands.

Purpose of the interview

I am currently developing a master thesis about parents' traffic and social safety perceptions and their relationship with children's mobility to school modes. As part of my research, I need to conduct an in-depth recorded interview on the urban form design and vision from the municipal/regional authority perspective. The structure I have prepared for the interview has three parts. I will first ask some questions regarding traffic safety background, then about the regulations that apply to Lima, and finally your personal opinion regarding this topic.

Duration of the interview

The interview is planned to last approximately from 30 to 40 minutes, but please don't feel restricted by it, if you want to share longer, we can continue.

Nature of the interview

The interview consists of open-ended questions, and close-ended questions and I will ask for a few basic biographical facts as well.

Please feel free and comfortable to share the details of your experience as there are no good or bad answers and nobody will judge them. If any of the questions feel uneasy or you don't want to answer them for any reason just let me know, there is no problem to clarify or let it unanswered.

Privacy and anonymity

The outcome of this interview will be used for research purposes only. It will be confidential and anonymous. You will not be referred by your name along with the interview or the study. If I need to cite you in some part of the research, you will be referred to as something "woman, 20's". The results will be stored in a safe file that will be accessed only by myself.

Informed consent to participate and record the interview

Before proceeding with the interview and now knowing in deeper detail the purpose and confidentiality of the research, I need to ask if I still have your consent to participate? Do you consent to using the outcome of the interview for research purposes? Do you consent to recording this interview?

(Consent to participate and record given)

You can withdraw this consent at any time during the interview or the research, we will stop and erase the recording. Do you have any questions before we start?

Date of interview: 12.08.2022

Respondent's Occupation: Professor

General traffic safety background

1. How would you describe the current status of traffic safety in Lima?
2. Is traffic safety a priority when designing/implementing/maintaining the traffic infrastructure?
3. What traffic safety challenges do schoolchildren face while commuting to school?
 - Have these challenges changed elementary schoolchildren's mobility behavior?

Traffic safety regulations

4. How is traffic safety planned and controlled in Lima?
5. Which institutions are in charge of traffic safety in Lima?
 - Are traffic safety actions coordinated among these institutions?
6. What norms and /or policies exist in Lima/Peru regarding:

- children's traffic safety?
- School zones traffic safety?

Personal opinion

7. Which factors are considered important in Lima while designing pedestrian areas?
8. What are the challenges to implementing safer pedestrian areas?
9. What do you think should be done to reduce traffic accidents that involve pedestrians and cyclists? Why?
10. How is the probability to experience traffic crashes in Lima? Why?
 - Low
 - Medium
 - High
11. Do you consider that traffic safety is a main determinant when parents decide on the commuting mode to school of their children?
 - Which other factors would be determinants?
12. In your opinion, which strategies should be implemented to improve traffic safety conditions for elementary school children in Lima?

Thank you for sharing your experience. I think I asked all my questions. Do you have anything to add to your conversation?

Semi-Structured Interview Guide – Urban Form

Introduction of the interviewer

Good morning/ good afternoon, thank you for finding time for this interview. My name is Jessica Huaylinos and I am a student in the Urban Development and Management master’s program at Erasmus University in Rotterdam, The Netherlands.

Purpose of the interview

I am currently developing a master thesis about parents’ traffic and social safety perceptions and their relationship with children’s mobility to school modes. As part of my research, I need to conduct an in-depth recorded interview on the urban form design and vision from the municipal/regional authority perspective. The structure I have prepared for the interview has three parts. I will first ask some questions regarding the urban design background of Lima, then about the regulations that apply to Lima, and finally your personal opinion regarding this topic.

Duration of the interview

The interview is planned to last approximately from 30 to 40 minutes, but please don’t feel restricted by it, if you want to share longer, we can continue.

Nature of the interview

The interview consists of open-ended questions, and close-ended questions and I will ask for a few basic biographical facts as well.

Please feel free and comfortable to share the details of your experience as there are no good or bad answers and nobody will judge them. If any of the questions feel uneasy or you don’t want to answer them for any reason just let me know, there is no problem to clarify or let it unanswered.

Privacy and anonymity

The outcome of this interview will be used for research purposes only. It will be confidential and anonymous. You will not be referred by your name along with the interview or the study. If I need to cite you in some part of the research, you will be referred to as something “woman, 20’s”. The results will be stored in a safe file that will be accessed only by myself.

Informed consent to participate and record the interview

Before proceeding with the interview and now knowing in deeper detail the purpose and confidentiality of the research, I need to ask if I still have your consent to participate? Do you consent to using the outcome of the interview for research purposes? Do you consent to recording this interview?

(Consent to participate and record given)

You can withdraw this consent at any time during the interview or the research, we will stop and erase the recording. Do you have any questions before we start?

Date of interview: 27.06.2022

Respondent’s Occupation: Arquitect

General urban design background of Lima

1. How would you describe the current status of urban planning and design in Lima?
2. Is the city following an urban development plan? Which one?
3. Are urban development strategies coordinated with urban mobility strategies in Lima?
4. Has the distribution and location of facilities such as schools in Lima followed an urban development plan?
 - There are schools in Lima located in industrial areas. Is this type of location for schools contemplated in the urban development plans for Lima?
5. What challenges does the urban design of Lima poses for schoolchildren face while commuting to school?
 - Do these challenges affect elementary schoolchildren’s mobility behavior?

6. Does the development of urban design strategies and actions in Lima consider the dynamics of schools that are close to them?

Urban design regulations

7. How is urban design planned and controlled in Lima?
8. Which institutions are in charge of urban design in Lima?
 - Are urban design actions coordinated among these institutions?
9. What norms and /or policies exist in Lima/Peru regarding:
 - Distribution and locations of schools?
 - Urban design around schools?

Personal opinion

10. Which factors are considered important in Lima while designing pedestrian areas?
11. What are the challenges to implementing safer pedestrian areas?
12. What do you think should be done to reduce traffic accidents that involve pedestrians and cyclists? Why?
13. How is the probability to experience traffic crashes in Lima? Why?
 - Low
 - Medium
 - High
14. Do you consider that urban form is a main determinant when parents decide on the commuting mode to school of their children?
 - Which elements?
 - Which other factors in addition to urban form would be determinants?
15. In your opinion, which strategies should be implemented to improve urban design conditions for elementary school children in Lima?

Thank you for sharing your experience. I think I asked all my questions. Do you have anything to add to your conversation?

Appendix 2: Data coding

Table 22: Variables used for data analysis

Variables used for data analysis	
Variable name	Variable description
Personal Characteristics	
Type of school	1 = Public school; 2 = private school
Child's age	6 = 6 years old; 7 = 7 years old; 8 = 8 years old; 9 = 9 years old; 5 = 10 years old
School grade (elementary level)	1 = 1 st grade; 2 = 2 nd grade; 3 = 3 rd grade; 4 = 4 th grade
Gender	1 = Female; 2 = Male
District of residence	1 = Breña; 2 = Other
Parent age	1 = < 30-year-old; 2 = 31–40-year-old; 3 = 41–50-year-old; 4 = > 51-year-old
Household characteristics	
Relationship with child	1 = Mother; 2 = Father; 3 = Sibling; 4 = Guardian
Monthly household income	1 = Low = Less than 1300 soles or 1300-2480 soles 2 = Mid = 2480-3970 soles or 3970-7020 soles 3 = High = More than 7020 soles
Occupation	1 = Full-time paid job; 2 = Part-time paid job; 3 = Only a homemaker; 4 = Other
Car ownership	0 = I can't say; 1 = Yes; 2 = No
Motorcycle ownership	0 = I can't say; 1 = Yes; 2 = No
Bicycle ownership	0 = I can't say; 1 = Yes; 2 = No
Driving license	0 = I can't say; 1 = One; 2 = More than one; 3 = None;
Education level	0 = I can't say 1 = Low (Elementary School) 2 = Mid (Elementary School) 3 = High (Technical or University) 4 = Other

Source: Author, 2022

Table 23: Group of variables for the analysis

Group	Variables
Mode choice from home to school	
1 = Active modes	Only Walking; Only cycling
2 = Public motorized	Public transportation, mototaxi, taxi / App taxi
3 = Private motorized	School van, own car, own motorcycle
Mode choice from school to home	
1 = Active modes	Only Walking; Only cycling
2 = Public motorized	Public transportation, mototaxi, taxi / App taxi
3 = Private motorized	School van, own car, own motorcycle
Distance from home to school	
<3km	1 km; 1km– 2 km; 2 km – 3 km;
>3km	> 3 km
0	I do not know
Past experiences	
Traffic crashes	0 = I can't say; 1 = Yes; 2 = No
Crime situations	0 = I can't say; 1 = Yes; 2 = No

Author (2022)

Table 24: Rating scales

Rating scale 0-4		
1. Factors shaping school mode choice	Code	0= I'm not sure 1 = Not important; 2= Less important, 3=important, 4 = Very important
	F1	Distance to school
	F2	Cost of transportation
	F3	Comfort
	F4	Security (crime rate)
	F5	Traffic safety (traffic accidents)
	F6	Weather
	F7	Time convenience
	F8	Because other parents do it as well
	F9	It is my only option
2. Perceived adequacy of urban form		0= I'm not sure 1 = Strongly disagree; 2= Disagree, 3=Agree, 4 = Strongly Agree
	UF1	Presence of sidewalks
	UF2	Sidewalks are wide enough
	UF3	Sidewalks are well-maintained
	UF4	Sidewalks have protection strip
	UF5	Presence of pedestrian ramps
	UF6	Presence of cycle paths
3. Perceived level of traffic safety		0= I'm not sure 1 = Strongly disagree; 2= Disagree, 3=Agree, 4 = Strongly Agree
	RS1	Intense traffic flow
	RS2	Low speeds
	RS3	Drivers respect pedestrian crossings
	RS4	Potential traffic crashes
	RS5	Drivers are imprudent
4. Perceived level of social safety		0= I'm not sure 1 = Strongly disagree; 2= Disagree, 3=Agree, 4 = Strongly Agree
	PS1	High crime rate
	PS2	Potential crime situation
	PS3	Alleys make route unsafe
	PS4	Dangerous people make route unsafe
5. Attitudes towards sustainable mobility		0= I'm not sure 1 = Strongly disagree; 2= Disagree, 3=Agree, 4 = Strongly Agree
	ASM1	Traffic emissions are a threat to the environment
	ASM2	Cars give status
	ASM3	More cars mean more traffic crashes
	ASM4	W&C benefit environment
	ASM5	Walking is an effective mode to mobilize in my neighborhood
	ASM6	W&C benefit health
	ASM7	Parking should be restricted in city centers
	ASM8	Pedestrian streets create traffic
	ASM9	Authorities should build more cycle lanes in my neighborhood
	ASM10	Cycling is an effective mode to mobilize in my neighborhood
	ASM11	Driving in my neighborhood is more effective than walking or cycling

Author (2022)

Appendix 3: Contingency tables

Table 25: Sociodemographic characteristics by type of school and children's travel mode to school

Indicator	Study sample (n=178)	Public Schools (n=113)			Private Schools (n=65)			All	All
		Active modes	Public motorized	Private motorized	Active modes	Public motorized	Private motorized		
Gender	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Female	81 (46%)	31 (55%)	24 (43%)	1 (2%)	56 (69%)	7 (28%)	6 (24%)	12 (48%)	25 (31%)
Male	97 (54%)	35 (61%)	19 (33%)	3 (6%)	57 (59%)	11 (28%)	4 (10%)	25 (62%)	40 (41%)
Age									
6	22 (12%)	7 (64%)	3 (27%)	1 (9%)	11 (50%)	4 (36%)	2 (9%)	5 (45%)	11 (50%)
7	42 (24%)	17 (55%)	11 (35%)	3 (10%)	31 (74%)	1 (9%)	1 (9%)	9 (82%)	11 (26%)
8	57 (32%)	21 (58%)	15 (42%)	-	36 (63%)	7 (33%)	5 (24%)	9 (43%)	21 (37%)
9	44 (25%)	14 (56%)	11 (44%)	-	25 (57%)	5 (26%)	2 (11%)	12 (63%)	19 (43%)
10	13 (7%)	7 (70%)	3 (30%)	-	10 (77%)	1 (33%)	-	2 (67%)	3 (23%)
Grade									
1 st	35 (20%)	8 (47%)	7 (41%)	2 (12%)	17 (49%)	5 (28%)	3 (16%)	10 (56%)	18 (51%)
2 nd	48 (27%)	26 (67%)	11 (28%)	2 (5%)	39 (81%)	1 (11%)	-	8 (89%)	9 (19%)
3 rd	50 (28%)	15 (52%)	14 (48%)	-	29 (58%)	6 (29%)	5 (23%)	10 (48%)	21 (42%)
4 th	45 (25%)	17 (61%)	11 (39%)	-	28 (62%)	6 (35%)	2 (12%)	9 (53%)	17 (38%)
Parent age									
Up to 30 years	30 (17%)	12 (44%)	13 (48%)	2 (8%)	27 (90%)	2 (67%)	-	1 (33%)	3 (10%)
31-40 years	83 (47%)	36 (65%)	17 (31%)	2 (4%)	55 (66%)	11 (39%)	3 (11%)	14 (50%)	28 (44%)
41-50 years	59 (33%)	16 (57%)	12 (43%)	-	28 (47%)	4 (13%)	6 (19%)	21 (68%)	31 (53%)
Over 51 years	6 (3%)	2 (67%)	1 (33%)	-	3 (50%)	1 (33%)	1 (33%)	1 (33%)	3 (50%)
Relationship with child									
Mother	153 (86%)	56 (58%)	38 (39%)	3 (3%)	97 (63%)	14 (25%)	10 (18%)	32 (57%)	56 (37%)
Father	20 (11%)	9 (82%)	2 (18%)	-	11 (55%)	4 (44%)	-	5 (56%)	9 (45%)
Guardian	5 (3%)	1 (0.2)	3 (0.6)	1 (0.2)	5 (100%)	-	-	-	-

Author (2022)

Table 26 : Household socioeconomic characteristics by type of school and children's travel mode to school

Indicator	Study sample (n=178)	Public Schools (n=113)			Private Schools (n=65)				
		Active modes	Public motorized	Private motorized	All	Active modes	Public motorized	Private motorized	All
Monthly household income	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Low	127 (71%)	60 (58%)	40 (39%)	3 (3%)	103 (81%)	6 (25%)	6 (25%)	12 (50%)	24 (19%)
Mid	41 (23%)	6 (60%)	3 (30%)	1 (10%)	10 (24%)	10 (32%)	3 (10%)	18 (58%)	31 (76%)
High	10 (6%)	-	-	-	-	2 (20%)	1 (10%)	7 (70%)	10 (100%)
Occupation									
Full-time work	75 (42%)	25 (68%)	10 (27%)	2 (5%)	37 (49%)	10 (26%)	2 (6%)	26 (68%)	38 (51%)
Part-time work	14 (8%)	4 (40%)	5 (50%)	1 (10%)	10 (71%)	1 (25%)	3 (75%)	-	4 (29%)
Only homemaker	45 (25%)	19 (58%)	14 (42%)	-	33 (73%)	1 (8%)	5 (42%)	6 (50%)	12 (27%)
Other	44 (25%)	18 (55%)	14 (42%)	1 (3%)	33 (75%)	6 (55%)	-	5 (45%)	11 (25%)
Car ownership									
Yes	43 (24%)	7 (70%)	3 (30%)	-	10 (23%)	6 (19%)	3 (8%)	24 (73%)	33 (77%)
No	129 (72%)	58 (59%)	39 (40%)	2 (1%)	99 (77%)	12 (40%)	7 (23%)	11 (37%)	30 (23%)
Can't say	6 (4%)	1 (25%)	1 (25%)	2 (50%)	4 (67%)	-	-	2 (100%)	2 (33%)
Motorcycle ownership									
Yes	24 (13%)	8 (53%)	5 (33%)	2 (14%)	15 (63%)	4 (44%)	1 (12%)	4 (44%)	9 (37%)
No	150 (84%)	56 (59%)	38 (40%)	1 (1%)	95 (63%)	14 (25%)	8 (15%)	33 (60%)	55 (37%)
Can't say	4 (3%)	2 (67%)	-	1 (33%)	3 (75%)	-	1 (100%)	-	1 (25%)
Bicycle ownership									
Yes	84 (47%)	25 (64%)	12 (31%)	2 (5%)	39 (46%)	12 (27%)	4 (9%)	29 (64%)	45 (54%)
No	92 (52%)	40 (56%)	31 (43%)	1 (1%)	72 (78%)	6 (30%)	6 (30%)	8 (40%)	20 (22%)
Can't say	2 (1%)	1 (50%)	-	1 (50%)	2 (100%)	-	-	-	-
Driver license									
Yes	105 (59%)	35 (64%)	18 (33%)	2 (3%)	55 (52%)	12 (24%)	7 (14%)	31 (62%)	50 (48%)
No	69 (39%)	29 (54%)	24 (44%)	1 (2%)	54 (78%)	6 (40%)	3 (20%)	6 (40%)	15 (22%)
Can't say	4 (2%)	2 (50%)	1 (25%)	1 (25%)	4 (100%)	-	-	-	-
Parent education level									
Low	4 (2%)	2 (50%)	2 (50%)	-	4 (100%)	-	-	-	-
Mid	48 (27%)	26 (59%)	17 (39%)	1 (2%)	44 (92%)	-	-	4 (100%)	4 (8%)
High	120 (67%)	36 (59%)	22 (36%)	3 (5%)	61 (51%)	17 (29%)	9 (15%)	33 (56%)	59 (49%)
Other	6 (4%)	2 (50%)	2 (50%)	-	4 (67%)	1 (50%)	1 (50%)	-	2 (33%)

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Appendix 4: Correlation and chi-square outputs

Table 27: Correlation and Chi-square test (two-tailed) between attitudes towards sustainable mobility and Commuting modes to school

	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Overall sample	0.0244	0.929	-0.0944	0.452	0.0736	0.589
Public school respondents	0.0828	0.518	-0.0675	0.674	-0.0435	0.756
Private school respondents	0.0638	0.671	-0.0413	0.356	-0.0275	0.915
Overall sample & Distance home - school within 3km	-0.0135	0.978	-0.1144	0.392	0.14	0.282
Public school respondents & Distance home - school within 3km	0.1131	0.181	-0.0945	0.282	-0.0516	0.752
Private school respondents & Distance home - school within 3km	-0.0295	0.584	-0.1138	0.085*	0.116	0.617
Overall sample & Distance home - school is "walkable"	0.0078	0.692	-0.115	0.223	0.1202	0.415
Public school respondents & Distance home - school is	0.048	0.892	-0.0406	0.849	-0.0223	0.863
Private school respondents & Distance home - school is	0.0508	0.584	-0.2817	0.036**	0.1499	0.752

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Table 28: Correlation outputs between socioeconomic variables

	Type_school	Distance	Household_monthly_income	Occupation	Car_ownership	Motorcycle_ownership	Education_level
Type_school	1.0000	0.1156	0.5768	-0.2355	-0.3724	0.0182	0.3384
Distance	0.1156	1.0000	0.2244	0.0301	-0.1587	0.0922	0.0731
Household_monthly_income	0.5768	0.2244	1.0000	-0.1385	-0.4953	0.0654	0.2782
Occupation	-0.2355	0.0301	-0.1385	1.0000	0.1268	-0.0059	-0.1021
Car_ownership	-0.3724	-0.1587	-0.4953	0.1268	1.0000	0.1960	-0.1786
Motorcycle_ownership	0.0182	0.0922	0.0654	-0.0059	0.1960	1.0000	-0.0454
Education_level	0.3384	0.0730	0.2782	-0.1021	-0.1786	-0.0454	1.0000

Author (2022)

Table 29: Correlation and Chi-square test (two-tailed) between Domains and Commuting modes to school

Overall sample	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.1594	0.014**	-0.0025	0.347	-0.1863	0.033**
Perceived level of social safety	0.0576	0.15	0.0457	0.248	-0.1179	0.264
Public school respondents	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.094	0.18	-0.0165	0.131	-0.2073	0.047**
Perceived level of social safety	-0.004	0.096	0.03	0.221	0.0682	0.337
Private school respondents	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.2071	0.177	-0.0892	0.606	-0.1222	0.599
Perceived level of social safety	0.1038	0.697	0.0134	0.932	-0.1035	0.7

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Table 30: Correlation and Chi-square test (two-tailed) between Domains and Commuting modes for distances to school within 3km

Overall sample & Distance home - school within 3km	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.1207	0.17	-0.0681	0.685	-0.0808	0.306
Perceived level of social safety	-0.0158	0.557	-0.0135	0.687	0.0347	0.841
Public school respondents & Distance home - school within 3km	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.111	0.543	-0.0106	0.714	-0.2187	0.079*
Perceived level of social safety	0.0284	0.352	-0.0016	0.74	-0.0582	0.291
Private school respondents & Distance home - school within 3km	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.128	0.584	-0.2426	0.257	0.0595	0.759
Perceived level of social safety	-0.0464	0.948	-0.0266	0.908	0.066	0.837

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Table 31: Correlation and Chi-square test (two-tailed-) between Domains and Commuting modes to school for perceived distance to school as “walkable”

Overall sample & Distance home - school is "walkable" (0=don know, 1=yes, 2=no)	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.0706	0.336	-0.0119	0.992	-0.083	0.147
Perceived level of social safety	0.0139	0.793	0.0583	0.469	-0.0853	0.622
Public school respondents & Distance home - school is "walkable" (0=don know, 1=yes, 2=no)	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.0374	0.905	0.0485	0.766	-0.1905	0.186
Perceived level of social safety	-0.0484	0.289	0.1003	0.315	-0.1059	0.442
Private school respondents & Distance home - school is "walkable" (0=don know, 1=yes, 2=no)	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.106	0.562	-0.2639	0.264	0.0797	0.443
Perceived level of social safety	0.0712	0.734	-0.0744	0.902	-0.0206	0.752

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Table 32: Correlation and Chi-square test (two-tailed-) between Domains and Commuting modes to school by household monthly income

Low income households	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.0949	0.122	-0.074	0.335	-0.0367	0.616
Perceived level of social safety	0.0016	0.061	0.0533	0.145	-0.082	0.447
Mid & High income households	Active Modes		Public Motorized modes		Private Motorized Modes	
	Correlation	p value (chi2)	Correlation	p value (chi2)	Correlation	p value (chi2)
Perceived level of road safety	0.2655	0.044**	0.0806	0.384	-0.3092	0.069*
Perceived level of social safety	0.2055	0.308	0.0211	0.98	-0.211	0.304

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