

Research Progress and Trends in Domestic Children's Commuting Based on Citespace

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Abstract: Children's commuting to school in China has given rise to new transportation and child-related issues due to the motorization of households and urbanization. To further explore the research progress and trends in domestic children's commuting, we conducted an analysis using Citespace software based on 154 documents from the CNKI database. The results indicate that research on travel characteristics has been a continuous focus throughout the research development, with recent attention on child-friendly design of school commuting spaces. Future research will prioritize considering children's rights, and there is an emerging focus on the design of supporting services for school commuting. This paper reveals the current research progress and trends in domestic children's school commuting, offering insights for future research.

1. Introduction

Since the 18th century, the significant revolution in transportation has led to the motorization of households, resulting in a shift from active to passive modes of children's school commuting. This situation has raised concerns regarding sustainable transportation and children's health.

2. School Commuting

Children's travel behavior often lacks attention [1]. Particularly, children's travel, especially school commuting, is typically determined by their parents [2]. The school commuting, referred to in this paper, is defined by the mode of transportation and travel characteristics. School commuting modes are categorized into independent commuting and accompanied commuting by others. Travel characteristics encompass travel mode, travel time, travel distance, and travel chains. Travel modes further include biking, public bus, subway, cycling, and electric vehicles [3].

3. Research Methodology

This paper employs a five-stage standard bibliometrics approach: research design, data collection, data analysis, data visualization, and interpretation [4].

3.1. Research Design

In this study, we will utilize CiteSpace for bibliometric analysis to explore the fundamental

characteristics, research progress, and trends in school commuting research.

3.2. Data Collection and Analysis

Following the PRISMA standard for data collection, data will be obtained from the CNKI database through subject term searches, keyword searches, and literature retrieval. Data selection will involve filtering based on document type and semantical relevance. The collected literature data will undergo analysis using CiteSpace, and interpretation will be conducted in conjunction with expert opinions.

4. Analysis Results and Explanations

The literature metadata comprises a total of 154 documents, including 70 journal papers, 66 theses or dissertations, and 18 conference papers. These documents originate from 65 different journals, with "Urban Transportation" publishing the most related articles (9 in total). There are 303 authors and 163 source institutions involved in this research domain. However, a prominent group of high-productivity authors has yet to emerge. The network of author-institution collaboration exhibits a tendency towards cooperation between geographically proximate units, with relatively fewer cross-regional collaborations. The author collaboration network demonstrates a relatively decentralized pattern of collaboration.

4.1. Research Overview

The earliest academic contributions on school commuting in China were published in 2007. Research in this field experienced a minor peak in 2013, and from 2014 onwards, it continued to gain momentum, signifying a burgeoning field of study.

4.2. Research Progress

Table 1: Keyword frequency and center ranking

Number	Frequency ranking		Centrality ranking	
	Frequency	keyword	Centrality	keyword
1	15	Child friendly	0.51	Middle and primary school
2	11	Built environment	0.44	Travel characteristics
3	9	Primary school students	0.36	Child friendly
4	6	Travel characteristics	0.27	School district
5	6	trip mode	0.27	Go to and leave school
6	6	Primary and secondary school students	0.25	Transportation
7	6	Optimizing strategy	0.25	Traffic improvement
8	5	Primary and secondary school	0.24	public space
9	5	General learning space	0.21	General learning path
10	5	Urban communications	0.21	Primary school

Research on school commuting analysis based on real-world investigations [8][9][11][12][17], suggestions for improving school commuting structures at the managerial or design level [5][6][7], the introduction of foreign practices related to school commuting [14][16], and studies focused on school commuting based on the built environment [10][13][15][18] have gained widespread recognition.

As shown in Table 1, it becomes evident that primary and secondary schools, especially elementary schools, constitute the foundational subjects of research in school commuting studies. Commuting characteristics form the core research content. A child-friendly approach is a prevailing value orientation in current research, while the influence of the built environment on school commuting mechanisms [19] [20] [21][22] has become a key focal point of investigation.

As shown in Table 2, it is evident that prior to 15 years ago, research on commuting to school primarily focused on transportation. Starting from 15 years ago, attention shifted towards examining the relationship between the built environment and school commuting, introducing the concept of active school commuting. The operation of school buses became a topic of concern. In 2019, the convergence of child-friendly urban development began to drive the focus on children's rights. Concepts such as active school commuting, active travel, walking to school, and green commuting gained popularity, leading to deeper reflections on the school district system, the relationship between housing and education, and urban morphology.

Research in the field of school commuting has consistently involved investigations and analysis of the structure of school commuting. In recent years, its scope has expanded to encompass the enhancement of child-friendly urban quality. Using the built environment to comprehensively guide school commuting, and considering school commuting as a link, concepts like school commuting space and school commuting environment have emerged. This essentially represents a more specific and targeted approach to studying the impact of the built environment on school commuting, and it is currently a trending area of research.

Table 2: Top15 keywords with the strongest citation bursts

keyword	Year	strength	Begin	end
Traffic characteristics	2007	1.77	2007	2011
Traffic jam	2011	1.59	2011	2013
Student	2011	1.59	2011	2013
School bus	2011	1.49	2011	2014
Urban communications	2011	1.34	2011	2014
Travel characteristics	2013	1.44	2013	2018
Trip mode	2011	1.68	2014	2017
School child	2014	1.53	2014	2017
School district	2015	1.35	2015	2018
General learning travel	2017	1.82	2017	2020
Travel behavior	2020	1.29	2020	2023
Children	2020	1.29	2020	2023
Child friendly	2019	3.84	2021	2023
General learning space	2021	1.7	2021	2023
General learning path	2021	1.7	2021	2023

From a stage-based perspective, the period from 2007 to 2017 can be considered the initial phase of research in which the focus was on traffic characteristics. This phase centered on addressing congestion issues, utilizing theoretical foundations such as the nl model and mnl model [21][22], with the objective of using the school commuting structure to alleviate urban traffic congestion and enhancing the safety and security of school commuting through traffic management and planning. Attention shifted to the impact of the built environment in 2015.

The period from 2019 to the present is the developmental phase, with a particular focus on child-friendly research within the context of the school commuting environment. Strategies for optimization have been proposed based on spatial pathways, and data sources such as GPS methods [23], point observations, surveys, and subway IC card data [24] have been employed. Analysis is carried out

using tools such as deep learning, GIS, and SPSS, making it a hot topic in recent research.

5. Conclusion and Outlook

The current research fundamentally acknowledges that parental motor vehicle transportation and the uneven distribution of educational resources are the two major factors contributing to school commuting congestion. This study presents recommendations in three key areas, including school management, organization of school front parking, traffic organization, traffic management, traffic safety education, housing and education structure planning, and land use planning.

Active school commuting is a widely recognized goal in research, but there is no standardized definition for its scope. This paper suggests that future research should contextualize the concept of active school commuting according to the local conditions of the study subjects. For instance, modes of active school commuting such as rail transit, public buses, and school buses should be incorporated, and further research should focus on optimizing the connectivity from pick-up/drop-off points to destinations. Hybrid school commuting modes that involve school buses and walking may be better suited for complex urban systems. Cities with favorable road conditions should also explore various means of school commuting, such as cycling and roller-skating.

Surveys on travel characteristics form the cornerstone of research. In the future, research can innovate in data collection methods and analysis techniques for school commuting. Simultaneously, research can continue to deepen the optimization of the school commuting environment with a child-friendly focus and the construction and organization of supporting facilities for school commuting.

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