



Children's Travel To School in Urban Areas: A Systematic Review of Different Application Models

*

Çisem Seyhan¹

ORCID: 0000-0002-7451-8377

Habibe Acar²

ORCID: 0000-0002-8682-0522

Abstract

This research focuses on children's transportation to school in urban areas. The first of the issues addressed in the study is the evaluation of research questions, objectives, methods used, with whom and how the research can be conducted while creating a research outline for this subject; the second includes evaluations were conducted on practices and new application models developed to support active travel between home and school for children in urban areas. In this context, this review evaluated 27 studies published between 2000 and 2019 covering the issues of walking or cycling to school from different aspects. The studies examined were handled under three main headings: the general content of the articles, their methods and procedures, and as research questions and results. According to the findings of the studies examined, seven research questions were created and concrete outputs related to the subject were presented through the answers of these questions. As a result, regarding active travel of children to school, measures to be taken in terms of safety, transportation, education, planning, design, and implementation were discussed.

Keywords: Active school travel, children, travel to school, urban areas, walkability to school

¹ PhD Student, Dokuz Eylul University, Graduate School of Natural and Applied Sciences, Department of City and Regional Planning, The Higher Education Council 100/2000 PhD Project Scholar in the Priority Area of Earthquake Studies,

E-mail: cisemseyhann@gmail.com

² Prof. Dr., Karadeniz Technical University, Faculty of Forestry, Department of Landscape Architecture,

E-mail: habibeacar@hotmail.com



Kentsel Alanlarda Çocukların Okula Ulaşimleri: Farklı Uygulama Modellerinin Sistematik Bir Derlemesi

*

Çisem Seyhan³

ORCID: 0000-0002-7451-8377

Habibe Acar⁴

ORCID: 0000-0002-8682-0522

Öz

Bu araştırma kentsel alanlarda çocukların okula ulaşımı konusuna odaklanmaktadır. Çalışmada ele alınan konulardan birincisi, bu konuda bir araştırma kurgusu oluşturulurken araştırma soruları, amaçlar, kullanılan yöntemler, araştırmanın kimlerle ve nasıl yürütülebileceği yönündeki değerlendirmeleri; ikincisi, kentsel alanlarda çocukların ev ve okul arası aktif seyahatlerini desteklemek için yapılan uygulamalar ve geliştirilebilecek yeni uygulama modellerine yönelik değerlendirmeleri içermektedir. Bu kapsamda 2000-2019 yılları arasında, okula yürüyerek ya da bisikletle ulaşım konularını farklı açılardan ele alan 27 araştırma değerlendirilmiştir. İncelenen çalışmalar; makalelerin genel içerikleri, yöntemleri ve prosedürleri; araştırma soruları ve sonuçları olmak üzere 3 ana başlıkta ele alınmıştır. İncelenen araştırmaların sonuçlarına göre 7 araştırma sorusu oluşturulmuş ve bu soruların cevapları üzerinden konu ile ilgili somut çıktılar ortaya konmuştur. Sonuçta, çocukların okula aktif seyahatleri konusunda güvenlik, ulaşım, eğitim, planlama, tasarrım, uygulama boyutlarında yapılması gerekenler tartışılmıştır.

Anahtar Kelimeler: *Aktif okul ulaşımı, çocuklar, okula ulaşım, kentsel alanlar, okula yürünebilirlik*

³ Doktora Öğrencisi, Dokuz Eylül Üniversitesi Fen Bilimleri Enstitüsü Şehir ve Bölge Planlama Anabilim Dalı, YÖK 100/2000 Deprem Çalışmaları Öncelikli Alanında Doktora Projesi Bursiyeri,

E-posta: cisemseyhann@gmail.com

⁴ Prof. Dr., Karadeniz Teknik Üniversitesi, Orman Fakültesi, Peyzaj Mimarlığı Bölümü,

E-posta: habibeacar@hotmail.com

Introduction

The population growth and density that has emerged with rapid urbanization, an important problem in the world and our country, has also revealed traffic and safety problems. Children, one of the groups affected by the resulting dangerous urban traffic and unsafe areas, are exposed to various safety concerns and vulnerable to traffic accidents on the way to school. The presence of active open spaces in the urban environment is of great importance for the child's physical, mental, and social development, and it is a basic need for children to be able to move freely in these spaces. At the same time, for children, free movement in these spaces is their right.

Due to increased traffic hazards and various safety issues and risks, concerns have arisen regarding children going out without adult supervision. For these reasons, there has been a transition from free play, where children leave the house to play in the street, park, or countryside, to scheduled and organized activities such as football lessons or dance lessons (Mackett, 2002). This situation has restricted children's freedom of movement in the open and brought about various health problems, such as obesity. Childhood obesity is a global problem that has increased significantly over the past 25 years. Although the reason for the increase in childhood obesity is multifactorial, the decrease in participation in physical activity is one of the most significant contributing factors. With the advancement of technology, increasing passive alternatives have distanced children from optional physical activity (Yelavich et al., 2008).

Studies show that children and young people who use active travel methods such as walking or cycling to and from school participate in daily physical activities, in contrast with those who use cars or buses. In addition, it has been observed that these children who go to or return from school have higher cardiovascular fitness than children who use motorized travel methods. Other researchers have also found that children who walk or cycle to school are more academically successful and are less stressed. All these findings suggest that walking or cycling to school should be perceived as a strategy to improve the health and well-being of children, and school transport policy should be part of the overall transport strategy, particularly with the development of a city-wide walking and cycling route network (Larouche et al., 2014).

This study underscores the significance of outdoor mobility, particularly walking or cycling to school, as a daily physical activity. The review discusses relevant studies and evaluates various application models within established criteria. Globally, practices are implemented to ensure the safe transportation of children between home and school. Initiatives like "Safe Routes to School," "Traveling to School Initiative," "Walking School Buses," "Pilot Yellow School Buses," and "Healthy Schools" address these concerns. The concept of "Safe Routes to School (SRTS)" originated in Denmark in the 1970s due to child safety worries, leading to laws enacted in 1976 for protecting children during their school commutes. A project in Odense in the 1980s reduced school travel accidents by 82%, making it a leading bicycle city in Europe, with 50% of school and city center trips now taken by bicycle (Osborne, 2005).

The "Safe Routes to School" concept has spread internationally, with programs thriving in Europe, Australia, New Zealand, Canada, and parts of the United States. The Bronx, a district of New York City, started the first Safe Routes to School program in the United States in 1997, and in the same year, a pilot program was implemented in the state of Florida. Later, it quickly spread and began to be implemented in more European countries (National Center for Safe Routes to School, 2007).

In England, the government by collecting annual data on school transportation prepare their own five-year local transportation plans, school transportation strategies, and progress reports (Tandoğan, 2014). The UK government has created a national "Traveling to School Initiative" to prepare a school travel plan for each school. Among these initiatives are programs encouraging walking and cycling, including "Healthy Schools", applications such as building new bicycle sheds in schools, Walking School Buses, bicycle lessons for travel between home and school, and "Pilot Yellow School Buses" (Osborne, 2005).

In the United States, free school buses have been provided for longer distances, but obesity concerns led to the adoption of the "Safe Routes to Schools" model (Osborne, 2005). Community-driven projects, like in East Cleveland, focus on pedestrian-friendly areas, emphasizing student involvement and safety enhancements (National Center for Safe Routes to School, 2007).

Several U.S. schools have innovative programs, such as Pedestrian Cards in Illinois, encouraging walking or cycling with rewards. In another application in Phoenix, Arizona, parents and schools worked together to

create "Safest Routes to School Maps". these maps helped city authorities prioritise repairing sidewalks and pedestrian paths. As a result, many of the inadequate pedestrian paths were upgraded (National Center for Safe Routes to School, 2007).

Lessons from Denmark, the UK, and other European countries emphasize separate paths for walking and cycling, speed limits, and prioritizing pedestrian and cyclist safety, resulting in reduced child injuries (Osborne, 2005). In conclusion, addressing children's transportation and recreational needs requires a multi-faceted approach, involving community engagement, safe infrastructure, and encouraging active travel. These initiatives aim to enhance child well-being and create a Child-Friendly Street environment.

Studies carried out in Turkey to ensure that children go to school safely are few. In addition, serious deficiencies can be seen in travelling to school on foot or by bicycle in Turkey compared to other countries. The limited number of academic studies on this subject shows the importance of the research. Based on these problems, the aim was to draw attention to the importance of the subject and to create a source for future research and application in terms of content and methods. As a result, based on the findings of the studies reviewed, suggestions have been made to develop transportation strategies by considering different alternatives for children's travel to school.

Material and Method

The main material of the research consists of studies conducted in different countries. In this context, in line with the stated objectives of the study, studies on transportation to school by walking or cycling were compiled. This included 27 studies published between 2000 and 2019 that were evaluated. The studies were accessed on the Internet from the Google Scholar browser by searching the keywords "Walkability to School", "Children's School Travel", "Traveling to School", and "Active School Travel".

Results

General Contents of Reviewed Articles

The authors of the 27 articles examined within the scope of this review, their publication dates, aims, the methods used to achieve their aims, their subjects or participants, and in which country they were conducted are given in Table 1. When evaluated according to publishing dates, the issues of school routes and access to school were shown to have been studied less frequently from 2005 to 2014, but this rate increased rapidly in 2014 and then decreased again. It was observed that the age group studied directly or indirectly (in the form of interviews with parents) varied between 5 and 18 but mostly consisted of the 11-year-old age group (12%).

Table 1. Studies evaluated and their contents.

No	Author/Year	Objective	Method	Participants/Subjects & Numbers	Country
1	Kerr et al., 2006	Comparing factors influencing active school travel: environmental perception, parental concerns, and structural factors	Survey	259 parents of children 5-18 years old	Washington, Seattle
2	Yelavich et al., 2008	To examine the primary school students who walk to school: frequency and related factors.	Survey	Children 5-10 years old	Dunedin, New Zealand
3	Watson & Dannenberg, 2008	To examine the potential wider impact of Safe Routes to School programs on communities within 0,5 km of schools	GIS	37 large urban areas, 428 small urban areas, 1088 metropolitan districts (districts in metropolitan statistical areas excluding urban areas), and 2048 non-metropolitan districts	USA
4	Van Dyck et al., 2009	To investigate whether children living in a walkable city center are more physically active than those living in a less walkable suburb	Survey, Pedometer, Activity log	120 children between the ages of 12 and 18	Izegem, Belgium
5	Napier et al., 2011	To test the roles of community design and parent-child perceptions of walkability in three communities: a walkable new urban community, a mixed community, and a less walkable standardized suburban community	Survey, GIS	193 Students 177 Parents	USA
6	D'Haese et al., 2011	To explore the link between parental environmental perceptions, family motor vehicle count, and children's school commuting mode (ac-	Survey, Routenet online route planner	969 parents with children aged 11-12	Belgium

		tive/passive) at considerable distances by identifying suitable walking and cycling distances to school.	(http://www.routenet.be)		
7	Babb et al., 2011	To summarize efforts in creating a composite walkability index for neighborhood environments based on children's school travel behavior, enhancing accuracy in reflecting their potential for active travel.	GIS	Implemented in a school district in Brisbane.	Europe, North America, Australia
8	Trapp et al., 2011	To examine the personal, social, and environmental factors affecting the behavior of cycling to school in primary school children, regardless of sex.	One-week travel diary, Survey, GIS	25 Primary-school students	Western Australia
9	Nasrudin & Nor, 2013	To examine the factors parents consider when deciding how to send their children to school and parents' attitudes towards green mobility.	Survey	98 Parents	Shah Alam Selangor Malaysia
10	Shokoohi et al., 2012	To examine whether socio-economic factors control the relationship between parents' perception of traffic safety and children travelling to school.	Survey	Parents of children 9-12 years old	Tehran
11	Mackett, 2013	To examine the nature of children's travel behavior and their impact on their physical activity and health volume.	Database scan	National Travel Survey, Project on children's car use conducted 2001-2004 at UCL, CAPABLE Project (2004-2006)	Britain
12	Shbeeb & Awad, 2013	To examine all the areas around the schools where students walk, including sidewalks and passages, driver and pedestrian behavior, aesthetics of the areas, and school location	Observation	231 Students	Jordan

13	Rothman et al., 2014	To estimate the proportion of children living within walking distance of the school and to identify the communities and the social-environmental relationships of the walk.	Observation, ArcMap	118 Schools	Toronto Canada
14	Larouche et al., 2014	To collect data on childhood obesity across individual, family, neighborhood, and school levels, and explore socio-demographic and school-level correlations of active school transportation.	Child survey, Parent survey, School principal survey, School field inspection	567 children, average age of 10 years	Ottawa Canada
15	Carver et al., 2014	To examine the latitudinal and longitudinal relationships between social, physical, and environmental variables and independent mobility	Survey, GIS	1121 children in the 9-10 age group	Norfolk United Kingdom
16	Oliver et al., 2014	To comprehend children's school commute behavior, considering daily weather, neighborhood walkability, and preferences	GIS, Interview, Trip diary	217 children in the 6.5-15 age group	New Zealand
17	Chillón et al., 2014	To examine the relationship between primary school children's active travel to school and the demographic and physical environment, perceptual barriers, and other norms.	Survey	18 schools with children aged 10-11	America
18	Lu et al., 2015	To investigate the role of children's and parents' self-efficacy in active travel to school, considering the socio-demographic and environmental structure.	Survey GIS	857 children and families 74 Schools	Texas
19	Kyttä et al., 2015	To study the degree of independent mobility of children	Survey	821 students in the 7-15 age group	Finland
20	Easton & Ferrari, 2015	To analyze student clustering in schools and residential neighborhoods, identifying reasons for	Cross-Sectional Analysis	26,709 students in the 11-16 age group	Sheffield England

		the significant increase in motorized travel instead of walking or cycling from home to secondary school.			
21	Janssen & King, 2015	To assess playability traits and compare physical activity levels among children in walkable and non-walkable school neighborhoods.	Survey (Health Research), GIS	3,912 students in the 6 th - 8 th grades	Canada
22	Waygood & Susilo, 2015	To explore if parents' perspectives on home choice influence children's walking to school and to what extent.	Survey	Parents in 48 different neighborhoods	Scotland
23	MacDonald et al., 2016	To establish a mixed "walkability score" for areas around primary schools and to investigate whether poorer areas score lower than richer areas.	Walkability Index, GIS	29 local authorities and 937 primary schools in 4 countries,	Scotland
24	Moran et al., 2017	To assess children's views on the route from home to school and measure its environmental characteristics.	Survey, Sketch Map drawings, GIS	92 students in the 10-12 age group	Rishon LeZion, Israel
25	Mah et al., 2017	To examine the relationship between parental support and children's active travel	Survey, GIS	341 students in grades 4-7 341 parents	Surrey, British Columbia, Canada
26	Ikeda et al., 2018	To define and examine the relationship between of children and young people's active travel to school and the neighborhood and built environment.	Meta Analysis GIS Database scan	2844 students in the 6-19 age group	New Zealand
27	Buttazzoni et al., 2018	To collect, organize, and evaluate data on all phases of active school travel interventions used	Database scan (BIOSIS pre-views, GeoBase, PubMed, SCOPUS, SPORTDiscus, Web of Science)	22 Studies	North America (Canada and USA)

Methods and Procedures

The methods used in the studies, the procedures of these methods and how the findings were evaluated can be considered as important reference material for similar studies conducted in the future. Accordingly, the 15 methods and processes used in the 27 studies are explained below.

1. Questionnaire: The questionnaire is a technique frequently used in environmental and behavioral research to learn the opinions of people about a particular subject or place. Survey technique procedures were specified in 27 of the articles examined.

- Parents were asked about the neighborhood surroundings, their concerns about their children walking to school and their thoughts about their children's behavior.
- In the study conducted in Dunedin primary school, an in-class survey was conducted with 1st, 2nd, 3rd, 4th, 5th and 6th-grade students. To learn their parents' opinions, a questionnaire form was prepared that the children took home for their parents to fill it out. The questionnaires were collected at the school approximately ten days later.
- Questions were prepared to learn what parents and students knew about walking and their opinions.
- A questionnaire form was prepared for parents on the mode of transportation for the children to and from school. The questionnaire contained the question, "How does your child usually go to school? By walking, bicycle, or motor transport (car, train, or bus)." The time it took for the children to go to school from home was also asked. In addition, parents were asked to indicate on which days their children usually come home during their lunch break.
- Qualitative and quantitative data about the parents (open-ended and structured questions) were collected simultaneously. Initially, parental consent and ethical approval were obtained. Later, the questions were answered by the children and parents.
- Children in schools were surveyed by trained staff to gather information on their modes and durations of travel to school, categorized as: walking; bicycle, skates, skateboard, scooter; bus, train, tram, underground, or boat; car, motorcycle, or moped; other. Those selecting 'other' specified their mode. Additionally, children reported their usual school travel times as: <5 minutes; 5–15 minutes; 16-30 minutes; 31 minutes to 1 hour, and >1 hour. Socio-demographic data were obtained via a parent questionnaire, covering annual household income, mother's education, number of motor

vehicles, and the child's sex and ethnic origin. School environment evaluation was conducted by a school administrator using items from the Canadian School Health Environment Survey.

- A questionnaire form consisting of 8 questions, asked separately for travelling to and from school, was prepared, and students answered each question on a scale ranging from 0 to 5.
- A questionnaire was applied to approximately 2,500 students in primary and secondary schools in five research areas and consisted of two parts: one for parents and one for children.
- Both questionnaires were sent home with the children. According to instructions, children and parents responded independently to their questionnaires. Parents sent their questionnaires filled and those of their children by mail in the prepaid envelopes provided.
- This technique was used in a continuous questionnaire of approximately 31,000 households over a two-year period and focused on three main policy areas: housing, social justice, and transport.
- A questionnaire containing the anthropometric and fitness measurements of the children was administered during the physical education classes. Consent forms and questionnaires prepared for the parents were sent home with the child to be filled out and returned.

Each study developed a questionnaire tailored to its content and objectives, adapting it based on the target participants (students, parents, teachers, administrators, etc.). However, to facilitate comparison of findings, sociodemographic and socioeconomic data were consistently included in the questionnaires. Participation in surveys was voluntary, and questions were framed as open-ended or on a 3-, 5-, or 7-option scale. Among the 27 articles reviewed, SPSS, SAS, or Stata IC programs were employed to analyze the data obtained through the questionnaire technique.

2. GIS: GIS is a technique that can associate the desired data to be used with each other and their geographical location and perform spatial analysis using these data. The application and procedures of the GIS technique were specified in 27 articles.

- Neighborhoods were stratified based on household income in the GIS environment.
- GIS was used to produce estimates of land areas within 0.5 miles of public schools in the four categories defined by the US Census.
- The distance between home and school was measured in the GIS environment.

- The walkability of schools to areas within a proximity of 2 km was measured in the GIS environment.
- Children's home addresses were mapped using the GIS (ESRI ArcGIS9.2) and Ordnance Survey database Mastermap Address Layer 2. Socioeconomic deprivation at the regional level was measured using the English Multiple Deprivation Index based on these addresses. Each child's neighborhood was defined as an area within an 800-meter pedestrian buffer zone for a 10-minute walk.
- GIS mapping software was used to geocode the location of each school concerning the population center of the unit postal code.
- Using GIS, each participant's home address was geocoded and school geographic files were obtained from the City of Surrey open data catalogue. The Network Analyst tool was used to calculate the shortest path (in meters) of the participants to school along the street network, and the statistical analysis was based on the distance to school as a continuous variable.
- Objective measurements of the built environment on actual home-school routes were obtained via GIS analysis. Using school and participant addresses, along with children-provided road maps, a GIS shape file for home-school routes was created.

GIS is crucial for processing and evaluating location data based on various parameters. In this study, reliable data were essential, so after preparing numerical bases, comparative evaluations were conducted in line with research objectives. The reviewed articles commonly utilized ArcGIS™ v10.1 and ArcView v9.2 (ESRI®, Redlands, CA) software in GIS analysis.

3. ArcMap: In the studies examined, road network buffer zones were created around schools to evaluate the proportion of roads within the boundaries of 1.6 km walking distance to the schools.

4. Routenet Online Route Planner: This method evaluates the different routes children use in their daily rounds. In the study using this method, the distances from children's homes to the school were objectively measured using the Routenet online route planner. The benchmarks were set to the distance at which at least 85% of active vehicles were located. After these distance criteria were determined, multilevel analyses were conducted to correlate going to and coming from school at these distances. The MLwiN 2.20 program was used in this study.

5. School Field Inspection: This method aims to reveal the current situation of a study area and its immediate surroundings from different angles.

Within the scope of the study examined, a single trained supervisor inspected the school area. With the creation of a photo dictionary, the school environment was seen as predominantly consisting of housing, open spaces/common areas/parks, business/retail establishments, and a mixture of different land uses.

6. Pedometer: A pedometer is used to measure people's daily physical activity levels and record them numerically. In the article examined, a pedometer was attached to 120 children for seven days and removed at the end of 7th day. The data obtained were evaluated with the help of SPSS software.

7. Activity Log: This method is used to determine the daily activities of people, and although they are not observed during the activity, it is possible to determine the frequency, location, and type of activity. In the study examined, 120 children wrote their actions for seven days in an activity log. The data obtained were evaluated using the SPSS program.

8. One-week Travel Diary: As with the activity log, this method determines weekly activity. In the study, children kept a travel diary for five days showing the mode of transportation to and from school. This was a modified version of a travel diary previously approved for children of similar age (9-11 years). The sampled travel diary included a pilot study of 160 children aged 10-12 years. The obtained data were evaluated using SPSS and Stata IC programs.

9. Daily Trip Diary: In this method, as in other diary methods, participants completed a travel diary for the previous seven days, including the first travel mode to school each day. Adults conducted the interview and travel diary on behalf of their children. The obtained data were evaluated with Stata IC programs.

10. Interview: This method is commonly employed to assess people's opinions on a subject. Interviews can use a pre-structured form or a semi-structured form with the flexibility to add new questions. In the interviews reviewed for this article, adults participated in a 40-minute computer-assisted personal interview with a trained interviewer. The interview covered individual and household demographic characteristics, neighborhood perceptions and preferences, and physical activities and sedentary behaviors. Data analysis was performed using Stata IC.

11. Observation: Behavioral observation is a method to understand how a space is utilized, including activities, participants, methods, and durati-

ons. It's the preferred way to determine usage and can be done semi-secretly or openly. Observations can be recorded in the field by researchers, on camera, or via recording devices. The studies under review employed the following observation procedures.

- The proportion of children walking to school was calculated from the total number of children observed, and observations were made at one-week intervals in 10% of schools, excluding children coming by school bus.
- The behavior of each pedestrian was observed, considering the travel time (such as walking time on sidewalks, transit time, and number of passes).

The data obtained were evaluated using the Statistical Analysis System (SAS).

12. Walkability Index: This index is based on calculating the walkability score by determining the variables that affect the walkability and the classification, mapping, or interpretation of the calculated scores within a specific value range. Considering that the variables potentially associated with walking were combined in the walkability score, one of the studies reviewed used the four-component walkability index method (including street connectivity, residential density, land use, and net area retail). The data obtained were evaluated using the SPSS pact program.

13. Sketch Map Drawings: This method, without specific routes or boundaries, aims to grasp an individual's knowledge and experiences of a place. In one study, it was employed to depict children's representations and knowledge of their home-school routes. Children were provided with an A4 blank sheet and instructed: 'Draw a map of your route from home to school and what you see along the way.' Data analysis utilized the SPSS program.

14. Database Scanning/Meta-Analysis: These methods involve accessing studies by scanning different databases for the keywords related to the subject to be examined to create a relevant database.

In the studies examined within the scope of the article, a keyword search was developed and applied to collect the academic literature in seven databases. A total of 22 studies assessing children's active school travel interventions in North America (4 in Canada, 18 in the USA) were identified between January 2010 and March 2017.

Scientific articles were searched on Google and in seven academic databases: SPORTDiscus, ABI/Inform, Web of Science, Scopus, NZResearch.org.nz, NewzText, and the Australian/New Zealand Reference Center. Unpublished research (New Zealand MSc and PhD theses) was accessed through various sources. Government and local council reports were obtained from major agency websites. Keywords such as 'active travel/transport', 'mode, travel/transport', 'school', 'New Zealand', 'walking', 'bike', 'trip and', and 'car' were used in English searches from January 1990 to June 2016. Evaluations were conducted between May and July 2016 using SAS.

15. Cross-Sectional Analysis: This method involved cross-analyzing data from relevant institutions, including socio-demographic characteristics, school type, transportation mode, and home-school distance. Evaluations were based on groupings by schools, neighborhoods, and school-home distances.

In the 27 studies examined, it was determined that among these 15 methods, the most frequently used were the survey (36%) and the GIS (28%). Accordingly, the survey is the method often preferred to obtain the opinions of different user groups. Similarly, GIS is an important tool for processing and interpreting location-based data in various research fields.

Research Questions and Results

In addition to the research methods, the objectives were evaluated. For this, first, the aims of the 27 studies were examined and divided into seven groups, expressed as research questions. The methods used in these articles and their results are given regarding the relevant research question. In this way, the concrete outputs of the articles (with numbers in table 1) were determined.

Research question: What are the factors affecting the journey to school?

Articles: 1; 2; 6; 8; 9; 10; 16; 17; 18; 20; 25; 27

Methods: Survey, GIS, Routenet Online Route Planner, One-week Travel Diary, Interview, Daily Trip Diary, Cross Analysis, Database Scan

Results:

- Both parental concern and environmental structure have an impact on children's actively travelling to school. To increase more active travelling

to school, there is a need for changes in the environmental structure as well as studies on plans to raise awareness.

- Proximity to school and lack of a car were identified as key factors in walking to school.

Inferences can be made from these findings affecting health, transportation, and education policies.

- The proximity to the home is important in considering how children get to school. Interventions to encourage actively travelling to and from school in children aged 11-12 should focus on increasing the accessibility from home of children living within 3 km of the school.
- The study revealed that, when going to school, boys predominantly rely on street proximity and deal with traffic issues, especially when using bicycles. Regardless of gender, families should foster their children's biking skills and promote bicycle use over driving.
- Studies on this subject reveal an accurate picture of city life in terms of transportation to school. However, families' concerns about safety were the main factor in not sending their children to school on foot or by bicycle, which showed that public safety must be increased.
- The number of cars in a household and household income were seen as the two main moderators. In addition, it was observed that the traffic safety perceptions of the parents varied according to different socio-economic conditions.
- Proximity to the school is the most important environmental impact factor in children's active access to school (e.g., walking, cycling). The research reviewed shows that, in conjunction with previous research, an important correlation exists between children's active access to school and school location.
- Parents' concerns can affect children's active travel to school. Therefore, future interventions should be capable of addressing parents' concerns to encourage active travel to school.
- Interventions that focus solely on changes in the built environment may not be sufficient to encourage active travel to school. Therefore, interventions to increase school travel should involve parents and children in the planning process.
- Research on society and political trends and factors that facilitate policy change can increase the sustainability of active school travel interventions by generating approaches to using intervention windows.

Research question: What are the effects of the "Safe Routes to School" program?

Articles: 3

Method: GIS

Results: "Safe Routes to School" projects show that they can improve the walking and cycling environment for adults and children as target users. Investing in "Safe Routes to School" can contribute to increased physical activity among children and adults.

Research question: How does school travel behaviour affect activity status?

Articles: 4; 5; 11; 13; 21; 22

Methods: Survey, Pedometer, Activity Log, GIS, Database Scan, Observation

Results:

- Contrary to previous results in adults, lower walkability in Belgian children and longer distance from school was associated with more physical activity. Therefore, physical environmental interventions designed for adults focusing on connectivity, housing density, and increased connectivity may not be effective for Belgian children.
- It turns out that children and parents often agree on walking obstacles, but in a less walkable society, parents perceive worse obstacles than their children. Walking to school is embedded into many types of support that must be addressed to encourage walking.
- Relationships between walking and population density and various road design features were confirmed.
- Compared to children from highly walkable neighborhoods, children from neighborhoods with poor walkability were very similar in engaging in physical activity outside of school in their spare time and reaching the recommended moderate-to-vigorous physical activity levels.
- Solutions that increase the "reasonable" walking distance children can walk, such as infrastructure elements that support walking and cycling in groups, can help increase overall active travel rates, but attention should also be paid to the choice of home location and the development of urban areas.

Research question: Evaluation of the school environment?

Articles: 12; 23; 26

Methods: Observation, Walkability Index, GIS, Meta-Analysis, Database Scan

Results:

- Pedestrians in Jordan have a higher risk of traffic accidents compared to some industrial countries, particularly affecting children under 15 (40% of the population). Those under five face the highest risk of traffic-related deaths. The study highlights that the chosen school environment is not conducive to walking. Guidelines are essential to address the safety needs of school-attending pedestrians.
- Walkability scores vary according to deficiencies, with patterns varying depending on the spatial scale of the analysis. Providing resources to less walkable areas is essential to improve opportunities to participate in active travel.
- It is important to develop policies regarding the school location and its drainage as well as pedestrian and bicycle infrastructure, so that children and young people can travel to school actively and safely.

Research question: What is the relationship between school transport and school level?

Articles: 14

Methods: Child questionnaire, Parent questionnaire, School administrator questionnaire, School field inspection

Results: It was observed that children in schools with safe roads to school and traffic-slowing measures are much more likely to participate in active school transport than those in schools that do not have these characteristics.

Research question: What are the factors affecting independent mobility?

Articles: 15; 19

Methods: Survey, GIS

Results:

- Implement interventions for parents to teach children independence and boost confidence in going out alone. City planners should design neighborhoods with coexisting residences, business/retail outlets, and sports facilities to promote active transport.
- Implement a program to evaluate urban, social, and health policies at local, regional, and national levels to identify potential impacts on children's independent mobility in various residential areas.

Research question: What is the perception of the children's school route environments?

Articles: 24

Methods: Survey, Sketch map drawings, GIS

Results: Children living in traditional neighborhoods in terms of route direction and structure performed better than others. The research reviewed on this topic emphasizes the importance of the urban form and the mode of travelling to school in acquiring navigation skills and getting to know the neighborhood.

Conclusions and Recommendations

Although children make up the majority of the world's population, they are among the most neglected groups, especially in urban areas. This situation negatively affects them physically, socially, and psychologically. The transportation of children between school and home is an important factor in terms of their personal development, as we have seen in many examples. When children travel between school and home independently of their parents, on foot or by bicycle, it has a direct effect on their fitness, success, and stress levels. In Turkey, children reach school with their parents or school buses, largely due to the location of the schools, traffic, and security concerns. This condition can lead to important problems such as: lack of physical activity in children, obesity, lack of independence, etc.

By examining examples worldwide, studies on this subject have yielded positive results. Going to school safely on foot or by bicycle is a daily activity that will help children create a sense of belonging and place. The increasing obesity problem and decrease in physical activity in children has recently been considered an important problem. Walking to school is a convenient and regular way to increase energy expenditure in children. This solution is a potential tool that will not only positively affect children's physical health, but also make them feel psychologically a part of society. In addition, this situation increases children's experiences about the environment and traffic and helps them gain experience, while also supporting their social, emotional and cognitive development.

In addition to all these advantages, reaching school by walking or cycling reduces environmental pollution, traffic congestion, etc. Supporting the reduction of these problems will contribute to the creation of more livable places. Considering the results obtained from the studies examined,

it is seen that the development of security, health, transportation, urbanization and education policies are the determining factors in increasing the rate of children walking to school. In Turkey, it is important to adopt special policies and solutions in urban planning and design that will support children to walk or cycle to school safely. At this point, new research is needed to evaluate the current situation regarding the safe transportation of children and to develop local solutions. Urban planning strategies should include solutions that prioritize pedestrians and bicycles in urban transportation and make public transportation systems child-friendly. It is also important to raise public awareness on this issue through educational programs. As a result, integrated planning and implementation strategies should be created to encourage children to go to school safely and actively. In addition to contributing to the healthy development of children, these strategies should also include broad perspectives such as environmental sustainability and social participation.

As a result, considering the importance of children's active travel to school, this issue should be prioritized in the current and future planning of countries and cities. To achieve this, it is first necessary to analyze and understand children's transportation methods to school, examine scientific research and application examples on the subject, and draw conclusions. In this respect, it is thought that the research will be an important resource. This research data was compiled in 2020. Therefore, studies between 2000 and 2019 were discussed. The scope of the research can be expanded with studies conducted on this subject since 2020. In addition, new location-specific research should be developed for practices on safe transportation to school by walking or cycling, and urban planning and design strategies should be determined by evaluating the results. Preparing a commuting plan between home and school, developing pedestrian-friendly streets, collecting annual data for school commuting, making local transportation plans, carrying out studies to regulate traffic on streets and avenues, ensuring public participation in these studies, improving children's environmental perception and determining fun school routes that will increase the level of creativity, implementing transportation solutions that will prioritize pedestrian and bicycle transportation throughout the city, and raising awareness through educational programs can be considered among these strategies.

References

- Buttazzoni, A. N., Van Kesteren, E. S., Shah, T. I., & Gilliland, J. A. (2018). Active School Travel Intervention Methodologies in North America: A Systematic Review. *American Journal of Preventive Medicine*, 55(1), 115–124.
- Carver, A., Panter, J. R., Jones, A. P., & van Sluijs, E. M. F. (2014). Independent mobility on the journey to school: A joint cross-sectional and prospective exploration of social and physical environmental influences. *Journal of Transport and Health*, 1(1), 25–32.
- Chillón, P., Hales, D., Vaughn, A., Gizlice, Z., Ni, A., & Ward, D. S. (2014). A Cross-Sectional Study of Demographic, Environmental and Parental Barriers to Active School Travel Among Children in the United States. *International Journal of Behavioral Nutrition and Physical Activity*, 11(1), 1–10.
- D'Haese, S., De Meester, F., De Bourdeaudhuij, I., Deforche, B., & Cardon, G. (2011). Criterion distances and environmental correlates of active commuting to school in children. *International Journal of Behavioral Nutrition and Physical Activity*, 8, 1–10.
- Easton, S., & Ferrari, E. (2015). Children's travel to school-the interaction of individual, neighbourhood and school factors. *Transport Policy*, 44, 9–18.
- Ikeda, E., Stewart, T., Garrett, N., Egli, V., Mandic, S., Hosking, J., Witten, K., Hawley, G., Tautolo, E. S., Rodda, J., Moore, A., & Smith, M. (2018). Built environment associates of active school travel in New Zealand children and youth: A systematic meta-analysis using individual participant data. *Journal of Transport and Health*, 9(February), 117–131.
- Janssen, I., & King, N. (2015). Walkable school neighborhoods are not playable neighborhoods. *Health and Place*, 35, 66–69.
- Kerr, J., Rosenberg, D., Sallis, J. F., Saelens, B. E., Frank, L. D., & Conway, T. L. (2006). Active commuting to school: Associations with environment and parental concerns. *Medicine and Science in Sports and Exercise*, 38(4), 787–794.
- Kyttä, M., Hirvonen, J., Rudner, J., Pirjola, I., & Laatikainen, T. (2015). The last free-range children? Children's independent mobility in Finland in the 1990s and 2010s. *Journal of Transport Geography*, 47, 1–12.
- Larouche, R., Chaput, J. P., Leduc, G., Boyer, C., Bélanger, P., Leblanc, A. G., Borghese, M. M., & Tremblay, M. S. (2014). A cross-sectional examination of socio-demographic and school-level correlates of children's school travel mode in Ottawa, Canada. *BMC Public Health*, 14(1), 1–11.
- Lu, W., McKyer, E. L. J., Lee, C., Ory, M. G., Goodson, P., & Wang, S. (2015). Children's active commuting to school: An interplay of self-efficacy, social economic disadvantage, and environmental characteristics. *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), 1–14.

- Macdonald, L., McCrorie, P., Nicholls, N., & Ellaway, A. (2016). Walkability around primary schools and area deprivation across Scotland. *BMC Public Health*, 16(1), 1–7.
- Mackett, R. L. (2002). Increasing car dependency of children: should we be worried? *Proceedings of the Institution of Civil Engineers-Municipal Engineer*, 151(1), 29–38.
- Mackett, R. L. (2013). Children’s travel behaviour and its health implications. *Transport Policy*, 26, 66–72.
- Mah, S. K., Nettlefold, L., Macdonald, H. M., Winters, M., Race, D., Voss, C., & McKay, H. A. (2017). Does parental support influence children’s active school travel? *Preventive Medicine Reports*, 6, 346–351.
- Moran, M. R., Eizenberg, E., & Plaut, P. (2017). Getting to know a place: Built environment walkability and children’s spatial representation of their home-school (h-s) route. *International Journal of Environmental Research and Public Health*, 14(6).
- Napier, M. A., Brown, B. B., Werner, C. M., & Gallimore, J. (2011). Walking to school: Community design and child and parent barriers. *Journal of Environmental Psychology*, 31(1), 45–51.
- Nasrudin, N., & Nor, A. R. M. (2013). Travelling to School: Transportation Selection by Parents and Awareness towards Sustainable Transportation. *Procedia Environmental Sciences*, 17, 392–400.
- National Center for Safe Routes to School. (2007). Safe Routes to School Guide. www.saferoutesinfo.org
- Oliver, M., Badland, H., Mavoa, S., Witten, K., Kearns, R., Ellaway, A., Hinckson, E., Mackay, L., & Schluter, P. J. (2014). Environmental and socio-demographic associates of children’s active transport to school: A cross-sectional investigation from the URBAN Study. *International Journal of Behavioral Nutrition and Physical Activity*, 11(1), 1–12.
- Osborne, P. (2005). Safe Routes for Children: What They Want and What Works. *Children Youth and Environments*, 15(1), 234–239.
- Rothman, L., To, T., Buliung, R., Macarthur, C., & Howard, A. (2014). Influence of social and built environment features on children walking to school: An observational study. *Preventive Medicine*, 60, 10–15.
- Shbeeb, L., & Awad, W. (2013). Walkability Of School Surroundings and Its Impact On Pedestrian Behavior. *TeMA*, 171–188.
- Shokoohi, R., Hanif, N. R., & Dali, M. (2012). Influence of the Socio-Economic Factors on Children’s School Travel. *Procedia- Social and Behavioral Sciences*, 50(July), 135–147.
- Tandoğan, O. (2014). More Livable Urban Space for Children: Practices around the World. *MEGARON*, 9(1), 19–33.

- Trapp, G. S. A., Giles-Corti, B., Christian, H. E., Bulsara, M., Timperio, A. F., McCormack, G. R., & Villaneuva, K. P. (2011). On your bike! a cross-sectional study of the individual, social and environmental correlates of cycling to school. *International Journal of Behavioral Nutrition and Physical Activity*, 8, 2–11.
- Van Dyck, D., Cardon, G., Deforche, B., & De Bourdeaudhuij, I. (2009). Lower neighbourhood walkability and longer distance to school are related to physical activity in Belgian adolescents. *Preventive Medicine*, 48(6), 516–518.
- Watson, M., & Dannenberg, A. L. (2008). Investment in safe routes to school projects: Public health benefits for the larger community. *Preventing Chronic Disease*, 5(3), 3–9.
- Waygood, E. O. D., & Susilo, Y. O. (2015). Walking to school in Scotland: Do perceptions of neighbourhood quality matter? *IATSS Research*, 38(2), 125–129.
- Yelavich, S., Towns, C., Burt, R., Chow, K., Donohue, R., Haji, S. H., Taylor, K., Gray, A., Eberhart-phillips, J., & Reeder, A. I. (2008). Walking to school: frequency and predictors among primary school children in Dunedin, New Zealand. *The New Zealand Medical Journal*, 121(1271), 51–58.

Çisem Seyhan

Lisans eğitimini 2017 yılında Atatürk Üniversitesi, Mimarlık ve Tasarım Fakültesi, Şehir ve Bölge Planlama Bölümünde, yüksek lisans eğitimini 2021 yılında Karadeniz Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Şehir ve Bölge Planlama Anabilim Dalında tamamlamıştır. 2021 yılından bu yana Dokuz Eylül Üniversitesi Fen Bilimleri Enstitüsü Şehir ve Bölge Planlama Anabilim Dalı'nda doktora eğitimine devam etmektedir. Ayrıca devam etmekte olan YÖK 100/2000 Deprem Çalışmaları Öncelikli Alanında Doktora Projesi Bursiyeri olarak desteklenmektedir. Başlıca araştırma konuları; şehir planlama, afet ve risk yönetimi, deprem çalışmaları, erişilebilirlik, mekânsal algı, kent imgesi ve çocuk-çevre araştırmaları olarak sıralanabilir. Bu konularda yayınlanmış ve yayın aşamasında bulunan akademik çalışmaları bulunmaktadır.

Çisem Seyhan completed her undergraduate education at Atatürk University, Faculty of Architecture and Design, Department of City and Regional Planning in 2017, and her master's degree at Karadeniz Technical University, Graduate School of Natural and Applied Sciences, City and Regional Planning Department in 2021. It still continues. She has been continuing her doctorate education at Dokuz Eylul University, Graduate School of Natural and Applied Sciences, Department of City and Regional Planning since 2021. In addition, the Higher Education Council is supported as a PhD Project Scholar in the Priority Field of 100/2000 Earthquake Studies she. The main research topics are; urban planning,

disaster and risk management, earthquake studies, accessibility, spatial perception, urban image and child-environment research. There are academic studies published and in the publication stage on these subjects.

E-posta: cisemseyhann@gmail.com

Habibe Acar

Lisans eğitimini Karadeniz Teknik Üniversitesi (KTÜ), Orman Fakültesi, Peyzaj Mimarlığı Bölümünde, yüksek lisans ve doktora eğitimini KTÜ Fen Bilimleri Enstitüsü Peyzaj Mimarlığı Anabilim Dalında tamamlamıştır. 2001 yılından bu yana KTÜ Orman Fakültesi Peyzaj Mimarlığı Bölümünde farklı akademik kadrolarda görev alan Habibe ACAR halen aynı bölümde profesör olarak lisans ve lisansüstü eğitim öğretim faaliyetleri ve akademik çalışmaları ile görevine devam etmektedir. Başlıca araştırma konuları; peyzaj tasarımı, insan-çevre ilişkileri, kent çalışmaları, olanaklılık teorisi, çocuk-çevre araştırmaları, çocuk oyun mekanları tasarımı, okul bahçeleri peyzaj tasarımı, çocuklar için açık alanlarda öğrenme ortamları, çocukların doğal alanlar ve elemanlarla ilişkileri olarak sıralanabilir. Bu konularda yayımlanmış ulusal ve uluslararası düzeyde akademik çalışmaları bulunmaktadır.

Habibe Acar graduated from Karadeniz Technical University (KTU), Faculty of Forestry, Department of Landscape Architecture. She completed her master and doctorate education in the Department of Landscape Architecture at the Graduate School of Natural and Applied Sciences at KTU. Since 2001, she has worked in different academic staff in the Landscape Architecture Department of the Faculty of Forestry at KTU. She still works as a professor in the same department with her undergraduate and graduate education activities and research. The main research topics are; landscape design, human-environment relations, urban studies, affordance theory, child-environment research, children's playground design, schoolyard landscape design, outdoor learning environments for children, children's relations with natural areas and elements. She has published national and international academic studies on these subjects.

E-posta: habibeacar@hotmail.com