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Improving Air Quality in Urban Areas by Enhancing Walking to School Programs: Addressing Mode Choice Barriers and Optimizing Walking Distance for Elementary School Students

Endang Widjajanti

Program Studi Magister Teknik Sipil Institut Sains dan Teknologi Nasional, Jl. Moch. Kahfi II, Bhumi Srengseng Indah, Kelurahan Jagakarsa – Jakarta Selatan 12620, Indonesia
* Corresponding author's e-mail: endangwidjajanti@istn.ac.id

Abstract

The purpose of this study is to determine the improvement in air quality that can occur if a walking-to-school program is implemented for elementary school students in the city of Depok. This research analyzes the transportation modes used by elementary school students to and from school in urban areas and the distance from their homes to school if they swalk. The study was conducted on students at SD Negeri Pasir Putih 03, Sawangan, Depok, to serve as a basis for programs aimed at encouraging students to walk to school. Data collection was carried out through field observations and interviews using a questionnaire via Google Forms, covering age, grade, address, departure and arrival times at school, modes of transportation used, and reasons for using them. Descriptive statistical methods were used to determine the walking distances of elementary school students by age. The most commonly chosen transportation mode for commuting to and from school was motorcycles (61.42%), followed by walking (29.96%). The rest used bicycles (2.80%) and a combination of walking and cycling. The analysis of walking distances for ages 6-13 showed that at the 50% cumulative percentage, the distance was less than or equal to 328 meters, with the shortest distance being 50 meters and the longest being 800 meters. Implementing a walking-to-school program for distances up to 100 meters is highly appropriate, as it not only improves students' health but also enhances air quality by reducing CO emissions during school hours. The estimated reduction in CO emissions with a moderate scenario during 1 hour in the morning along the distance between the gathering point and the school (100 meters) in Depok city is 431 grams/day or equivalent to 87 kg/year.

Keywords: air quality, walking, elementary school students, urban areas, walking distance

INTRODUCTION

Since every journey begins and ends on foot, all transportation users are pedestrians. In addition to its transportation function, walking is beneficial for health and can make a positive contribution to the environment, as it can reduce pollution produced by motor vehicles. Walking is considered an environmentally friendly and accessible method of transportation (Ananda et al, 2022). The distance that must be covered by walking is a very important factor in determining the choice of transportation mode for elementary school students. Often, students have to travel relatively long distances to reach school. Long distances can have a significant impact on the level of physical fatigue, time required for travel, and mental readiness of students (Makalev et al, 2023).

Walking is becoming less common due to the increasing use of motorized vehicles. People prefer to use cars/motorcycles due to cost, flexibility, convenience, travel time and weather protection (Gatersleben & Uzzell, 2007). Travel to school has also changed in recent years, with walking and cycling being replaced by motorized modes of transportation. School shuttles reduce physical activity and contribute to traffic congestion, especially during the morning rush hour (McDonald & Aalborg 2009; Carver et al. 2013a).

Conditions like the above also occur in Indonesia, especially in urban areas where research is needed to find out how the trends occur. In September 2023, the local government of Depok

City launched a joint walking to school program to re-familiarize children to walk to school, which has been determined by a gathering point with a distance of 50 to 100 meters from the school (berita.depok.go.id, 2023) to automate the walking distance of elementary school students, This activity aims to get children used to walking, children are healthier and move a lot and are active in accordance with their growth and development. In addition, so that children can socialize with their friends. SD Negeri Pasir Putih 03, Sawangan, Depok was chosen because it is considered to represent the general condition of elementary schools in urban areas that can be accessed by students on foot.

The purpose of the study was to determine the improvement in air quality that occurs when a joint walking program to school is implemented by knowing the mode of transportation used by students to / from school and the proportion of students who go to / return from school on foot and the walking distance based on the age of the students of Pasir Putih 03 State Elementary School, Sawangan, Depok who walk from home to school and vice versa.

OVERVIEW

Walking to School as an Active Journey to School

Trips to school have undergone changes. Around three decades ago, most children commuted to school on foot or by bicycle. However, in recent years, walking and cycling have been overtaken by motorized transport modes. Children (ren) being driven to school engenders inactivity and contributes to traffic congestion, especially in the AM peak hour (McDonald & Aalborg 2009; Carver et al. 2013a). To address the situation, ways to 'revive' active trips to school (ATS) are being analyzed (Buliung et al. 2011). The influences of different factors on school mode choice have been much studied (Bringolf-Isler et al. 2008; Larsen et al. 2009; Mitra et al. 2010). The impacts of trips to school on physical health have also been examined, with walking and cycling trips being the most common trips studied (Mitra & Buliung 2015; Stanley et al. 2015).

Walking as a mode of transportation offers various benefits, namely:

Environmental Aspects:

- Walking produces no direct emissions, thus contributing to the reduction of air pollution and greenhouse gas emissions.
- Research by Andersen et al. (2015) estimated that replacing 5% of car trips with walking could reduce CO2 emissions by 5 million tons per year in Europe.

Health Aspects:

- The WHO recommends 150 minutes of moderate-intensity physical activity per week, which can be achieved through regular walking.
- A study by Kelly et al. (2014) showed that regular walking can reduce the risk of cardiovascular disease, type 2 diabetes, and some cancers.

Economic Aspects:

- Walking does not require fuel costs or vehicle maintenance, so it can save individuals money.
- Pedestrian infrastructure is generally cheaper than motorized infrastructure.

Social Aspects:

- Walking can increase social interaction and a sense of community in urban environments.
- Pedestrian-friendly cities tend to have higher levels of safety and a better quality of life.

Air Pollution

Air pollution is one type of environmental pollution. Two causes of air pollution are:

1. Naturally such as dust blown by the wind, dust from volcanic eruptions, decaying

garbage and others.
2. As a result of human actions, which can generally be divided into two parts, namely those from mobile sources (motorized vehicles, ships, etc.) and immobile sources, namely industrial activities.

The effects of air pollution on human health occur in the respiratory tract and organs of vision. Visually, air pollution can be seen from motor vehicle fumes (Abner, 2009). The most harmful pollutant to health is particulate matter, followed by NOx, SOx, hydrocarbons and carbon monoxide, which is the least toxic. In line with development in the industrial and transportation sectors, air pollution by combustion gases has also increased. The gas harmful to health is carbon monoxide (CO) gas, which is the combustion residue of carbon-containing fuels. One of the producers of CO gas in the air is motorized vehicles.

CO Emissions from Motorized Vehicles

The definition of Emissions according to Government Regulation Number 22 of 2021 is air pollutants resulting from human activities that enter and/or are introduced into the air. Emissions may or may not have the potential to become air pollutants."

Vehicle gas emissions are the residue of combustion in an internal combustion engine. *This combustion* residue *will come out through the exhaust system or muffler*. Harmful substances in vehicle gas emissions are:

1. CO (Carbon Monoxide), this gas has no color and no odor. However, this gas is very toxic when inhaled by humans. The most fatal result will result in fainting until death.
2. CO2 (Carbon Dioxide), this gas has a very dangerous impact because it greatly affects global warming.
3. NOX (Nitrogen Oxide), this gas can cause respiratory problems and is very painful to the eyes.
4. HC (Hydrocarbon), this gas comes from incomplete combustion in the car engine, so in this gas there are still remnants of gasoline vapor that are not burned and come out through the exhaust.

The three main factors that affect motor vehicle emissions on the road are the volume of motor vehicles, motor vehicle characteristics and traffic conditions (Ofrial et al., 2016). Motor vehicle carbon monoxide (CO) emissions in this study are influenced by the length of the road segment, the number of motor vehicles and vehicle emission factors. Emission factor is the mass of pollutants (grams) released by motor vehicles every kilometer traveled (Tarigan, 2009).

Vehicle Emission Load

Emission load is the mass of pollutants released into the air by traffic as a source of air pollution in a given unit of time (Sengkey, et al., 2010).
Calculation of emission load for a pollutant from motor vehicles on a road section using the following equation:

$$E = \sum_{t=1}^{n} L\, x N_i x F_i \quad \text{..... 1)}$$

Where
E = CO gas emission on the road segment (gram/hr)
L = segment length

N_i = number of motor vehicles type i (kend/hr)
F_i = Type i motor vehicle emission factor

The emission factor values used are vehicle exhaust emission factors for metropolitan cities and large cities in Indonesia, which are determined based on vehicle categories/types based on the Regulation of the Minister of Environment No. 12/2010 on the Implementation of Air Pollution Control in the Region. The emission factor values are presented in the following table.

Table 2. Indonesia CO Emission Factor Values

Categories for air pollutant load calculation	CO g/km
Motorcycle	14
car (gasoline)	40
car (diesel)	2,8
car (other types of fuel)	32,4
Bus	11
Trucks	8,4

Source: Minister of Environment Regulation No. 12 Year 2010

Overview of Depok City

Depok City is a city located in West Java Province, Indonesia. Depok City is part of the Jabodetabek metropolitan area and is located in the southern part of the Special Capital Region of Jakarta. Depok City was formed from the Depok Administrative City area with the addition of areas from Limo Subdistrict, Cimanggis Subdistrict, and Sawangan Subdistrict, as well as some villages from Bojonggede Subdistrict which were combined with Pancoran Mas Subdistrict.[4] The inauguration date of Depok City is designated as Depok City Anniversary. The population of Depok City based on data from the Ministry of Home Affairs of the Republic of Indonesia in mid-2023 was 1,927,867 people (Depok City in Figures, 2023).

Number of Schools and Students, Elementary Schools (SD) by Subdistricts in Depok City, 2021/2022

Disrict	School			Stidents (1/1000)		
	Public	Private	Total	Public	Private	Total
Sawangan	21	19	40	8,418	3,152	11,57
Bojongsari	14	20	34	7,306	3,483	10,789
Pancoran Mas	24	30	54	13,834	8,898	22,732
Cipayung	13	18	31	8,421	5,419	13,84
Sukmajaya	31	24	55	15,065	6,478	21,543
Cilodong	18	13	31	9,615	4,338	13,953
Cimanggis	22	26	48	12,364	7,024	19,388
Tapos	30	17	47	15,694	3,398	19,092
Beji	18	14	32	8,727	3,492	12,219
Limo	9	15	24	5,075	3,588	8,663
Cinere	7	10	17	3,174	2,771	5,945
Depok City	**207**	**206**	**413**	**107,693**	**52,041**	**159,734**

Source: Depok City Central Bureau of Statistics. 2023

Walking Program for Elementary School Students in Depok City

This program was launched in September 2023, where the Depok City Office of Women's Empowerment, Child Protection, Population Control and Family Planning (DP3AP2KB) launched a joint walking to school program to re-familiarize children to walk to school which has been determined at a gathering point with a distance of 50 to 100 meters from the school, the program in the local language is called Ngabring ka Sakola (Ngabaso) (berita.depok.go.id, 2023) This activity aims to get children used to walking, children are healthier and move a lot and are active according to their growth and development. In addition, children can socialize with their friends.

RESEARCH METHODOLOGY

The research methodology is presented in Figure 1.

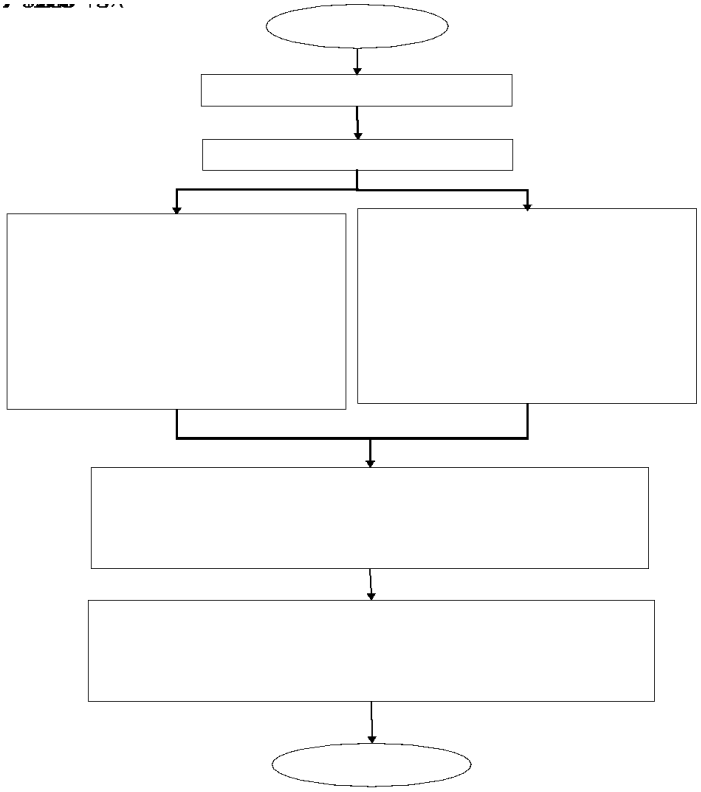


Figure 1. Research Flow Chart

Research Location

The project location of Pasir Putih 03 State Elementary School, Sawangan, Depok is located on Jl. Raya Pasir Putih Sawangan, Depok city which is adjacent to a residential area, Depok City as part of the Jabodetabek agglomeration (Jakarta-Bogor-Depok-Tangerang-Bekasi) is a

city in the south that supports the capital city of DKI Jakarta, where some workers in DKI Jakarta reside in Depok City. (Figure 2)

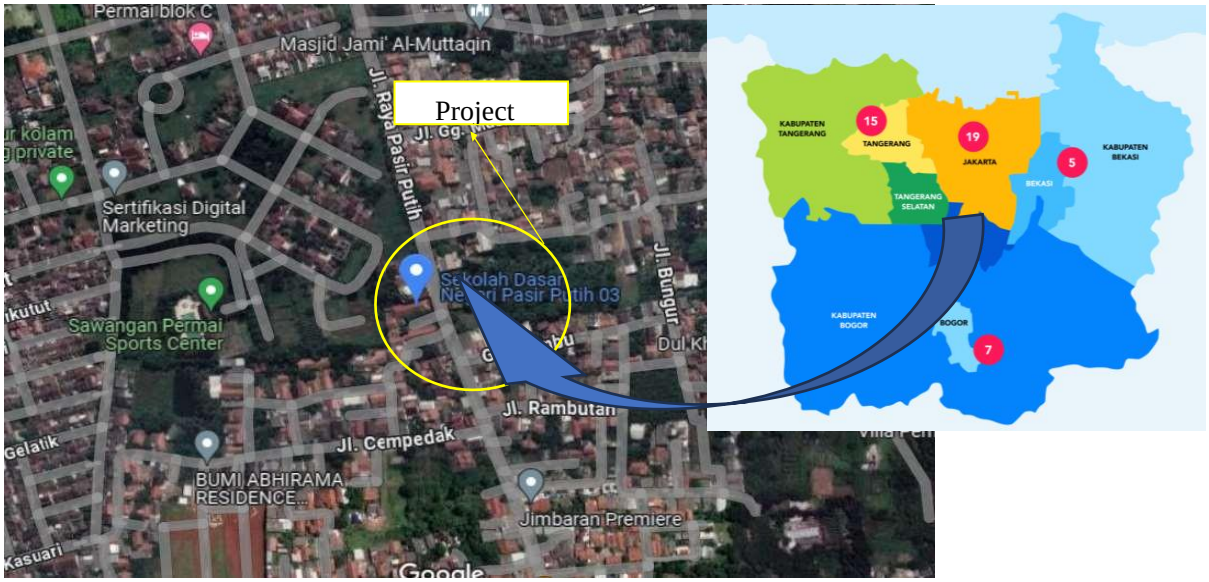


Figure 2. Study Location
(Source: *Google maps, 2024*)

Data Collection

The collection technique used in this study was through questionnaires to obtain data on mileage and individual student characteristics such as age and grade level. Questionnaires, to obtain the necessary information for research purposes. The questionnaire will be carefully structured to cover various related variables, such as distance traveled on foot, travel time, as well as other factors that may affect student mobility.
The questions asked through the questionnaire included.

1. Date of Birth
2. Home Address
3. Mode of travel to school (departure and return)
4. Reason for mode use (optional)

The distance traveled by students was obtained from measurements on the distance map between the student's address and SDN Pasir Putih 03 Depok. The survey was conducted in October-November 2023.

RESULTS AND DISCUSSION

The gender of the respondents was relatively balanced. By grade level, the largest was grade 6 (20%) and was almost evenly distributed with the smallest being grade 5 students (13.6%). The smallest student age was 6.8 years and the largest was 12.9 years. The gender and age distribution of respondents is presented in Table 3 and Table 4.

Table 3. Characteristics of Respondents Based on Class and Gender

Grade	Male	Female	Total	Grade	Male	Female
Class 1	33	47	80	Class 1	41%	59%
Class 2	42	47	89	Class 2	47%	53%
Class 3	30	35	65	Class 3	46%	54%
Class 4	45	23	68	Class 4	66%	34%
Grade 5	32	30	62	Grade 5	52%	48%
Grade 6	57	43	100	Grade 6	57%	43%
Total	239	225	464	Average	52%	48%

Source: Analysis Results, 2023

Table 4. Characteristics of Respondents Based on Age (Years)

Age (years)	Number of Students s	Percentage
6.00-6.99	17	3,7%
7.00-7.99	76	16,4%
8.00-8.99	82	17,7%
9.00-9.99	73	15,7%
10.00-10.99	67	14,4%
11.00-11.99	77	16,6%
12.00-12.99	72	15,5%
Total	464	100,0%

Source: Analysis Results, 2023

Road Condition

Pavement condition in front of SDN Pasir Putih 03 (Jl. Pasir Putih) with a road width of 5 meters. Jalan Raya Pasir Putih, Sawangan, Depok has inadequate pedestrian facilities. Along the road starting from the front of Pasir Putih 03 State Elementary School to 100 meters from the elementary school there are no pedestrian facilities, only road shoulders for students to walk. The cross-sectional dimensions of the road are presented in the following figure.

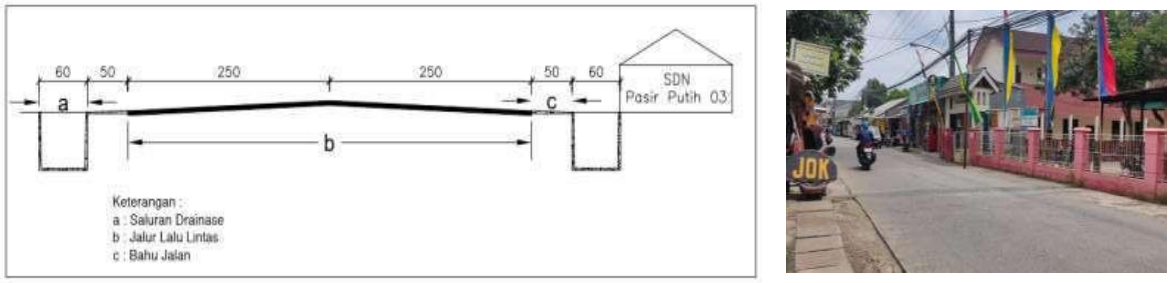


Figure 3. Cross Section of Pasir Putih Road

Home to School Distance

The closest house to the school is 50 meters and the farthest is 22 km. The following figure shows that Pasir Putih 03 State Elementary School, Sawangan, Depok is located in a residential

area up to a radius of 5 km-10 km. This shows the density of housing around the school.

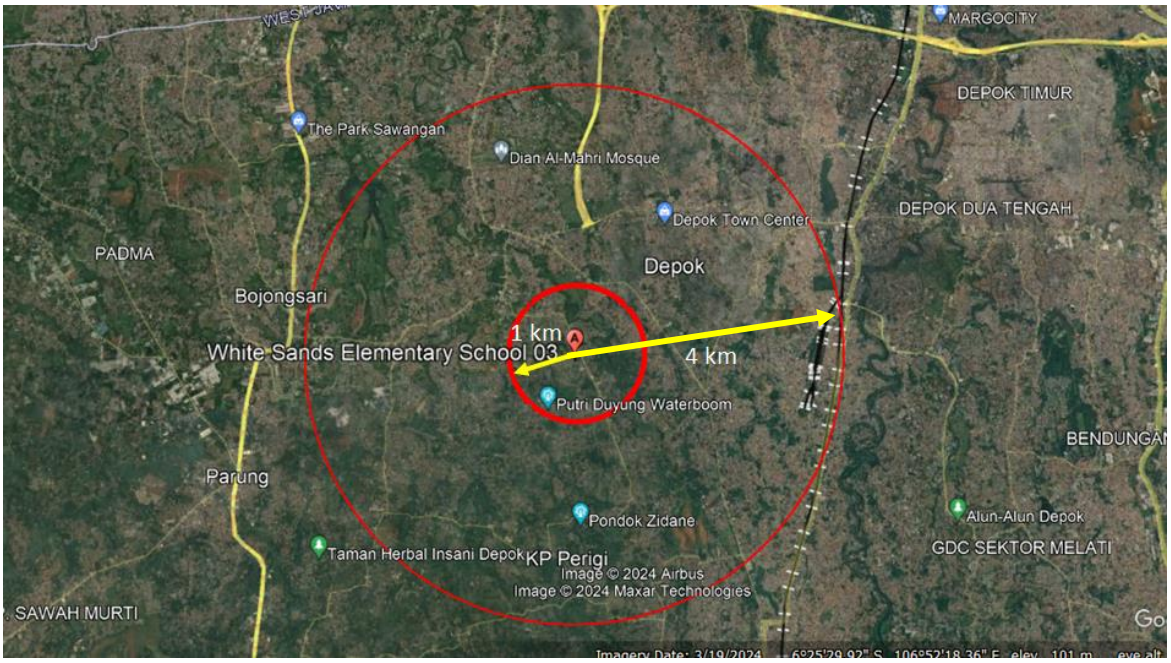


Figure 4. Area Around the School
Source: *Google earth, 2024*

Mode of Transportation used by Students

The mode of transportation used to go to and from school by students of SDN 03 Pasir Putih Sawangam, Depok is the highest, with 61.42% of the total 464 students using motorcycles, while walking comes second (29.96%), the rest using bicycles 2.80% and a combination of walking and cycling. Only 1 student used a car (0.22%), a combination of walking with a bicycle 1.29%, walking with a motorcycle 2.80% and a bicycle with a motorcycle 1.51%.Here it can be seen that although the school area is a residential area that tends to be close, the number of students who walk to/from school is relatively not large, only 139 out of 644 students or around 30%. However, this figure is relatively high compared to the study conducted by Back L.F (2008) where the modes used by students to get to school are school buses (39.6%), walking (14.2%), and family cars (46.3%) and by Mac Donald N.C. (2007) where nationally in the United States from 1969 to 2001 there has been a decrease in the number of students walking from 40.7% to 12.9%. The mode of transportation to/from school of SDN 03 Pasir Putih Sawangan, Depok by age is presented in Table 5.

Table 5. Modes used by students to get to school by age

Age Range	Walking	Bicycling	Motor cycle	car	Combine			Total	%
	1	2	3	4	1 & 2	1 & 3	2 & 3		
6.00-6.99	3	0	13	0	0	1	0	17	3,7%
7.00-7.99	21	1	52	0	0	2	0	76	16,4%
8.00-8.99	20	2	54	0	2	3	1	82	17,7%
9.00-9.99	27	3	38	0	1	2	2	73	15,7%
10.00-10.99	22	1	43	0	0	1	0	67	14,4%
11.00-11.99	28	0	42	0	2	2	3	77	16,6%

Age Range	Walking	Bicycling	Motor cycle	car	Combine			Total	%
	1	2	3	4	1 & 2	1 & 3	2 & 3		
12.00-12.99	18	6	43	1	1	2	1	72	15,5%
Total	139	13	285	1	6	13	7	464	100,0 %
%	29,96%	2,80%	61,42 %	0,22 %	1,29 %	2,80%	1,51 %	100,00 %	

Source: Analysis Results, 2024

The reason why parents choose the three main modes used by students, namely motorcycles, walking and bicycles is :

a. Motorcycle Mode

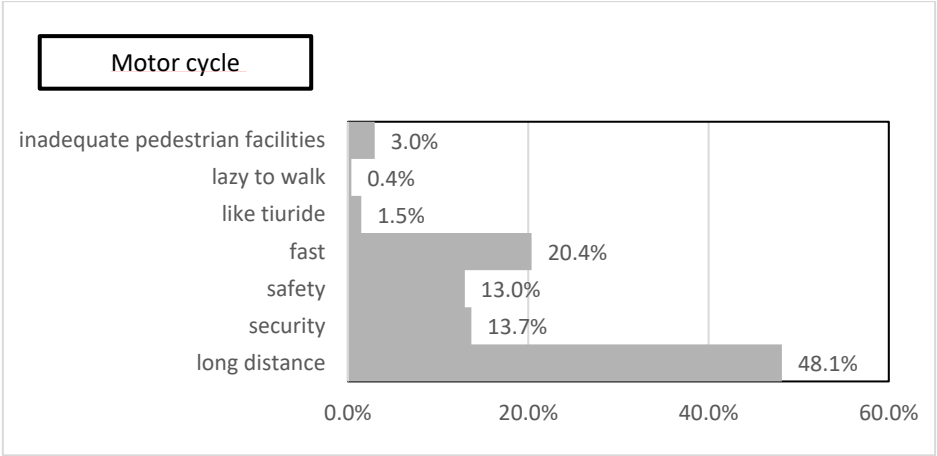
Of the 285 students who use motorcycles, 270 parents stated the reasons why they chose this mode, the most common being that the distance from home to school is far, besides that it is faster, safer and safer (because parents take them),

b. Walking

The reasons for students who walk, out of 139 students, 136 parents stated the reasons why they chose this mode, most (86%) stated because the distance from home to school is close, the rest are good for health (6%) and others (8%).

c. Bicycle

The biggest reason for choosing the bicycle mode is because they like it and because it is faster.



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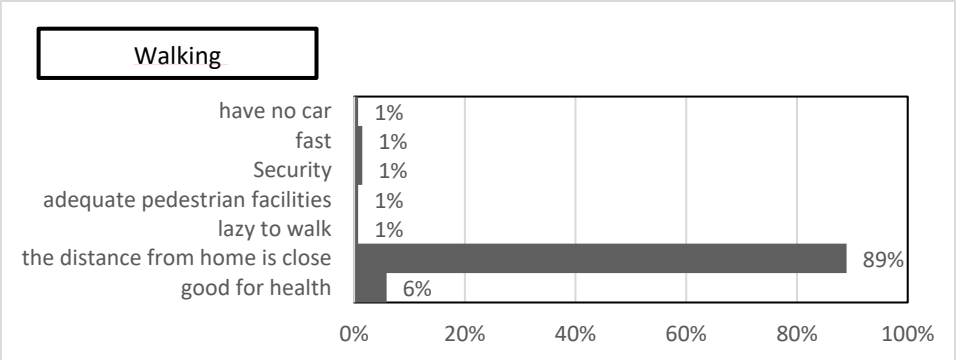

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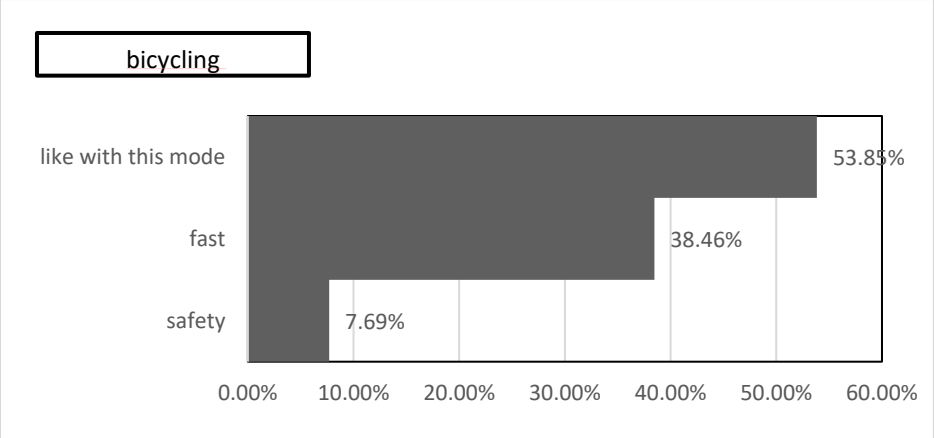


(c)

Figure 5. Reasons for choosing mode of transportation to/from school

Modes Used Based on Distance from Residence to School

The mode use based on the distance of residence to the school besides the private vehicle mode (because it was only done by 1 respondent) is presented in Table 4. From the table, it can be seen that the walking mode is chosen by students at a distance of 800 meters. If the distance from home to school is more than 800 meters, then students are more likely to be dropped off and picked up by motorcycle or a combination of walking with other modes of transportation, such as bicycle and motorcycle; The use of motorcycles does not correlate specifically with distance. As can be seen in Table 6, the use of motorcycle transportation is chosen by parents of students for both near and far distances.

Table 6. Use of Transportation Modes Based on Distance from Residence to School

home to school distance (meters)	Walking (W)	Bicycle (B)	Motor cycle (MC)	W&B	W&MC	B&MC	Total
1-100	3	0	0	0	0	0	3
101-200	28	3	2	0	0	0	33
201-300	49	1	14	2	4	1	71
301-400	33	1	7	2	2	0	45
401-500	19	3	15	0	0	0	37
501-600	1	0	3	0	0	0	4
601-700	4	1	14	1	3	1	24
701-800	2	0	11	0	0	0	13
801-900	0	0	5	0	3	0	8
901-1000	0	0	30	1	1	0	32
1001-1100	0	0	12	0	0	1	13
1101-1200	0	0	7	0	0	0	7
1201-1300	0	2	19	0	0	0	21
1301-1400	0	0	6	0	0	0	6
1401-1500	0	0	5	0	0	0	5
1501-1600	0	0	4	0	0	0	4
1601-1700	0	0	15	0	0	0	15
1701-1800	0	1	20	0	0	0	21
1801-1900	0	0	10	0	0	1	11
1901-2000	0	0	3	0	0	0	3

home to school distance (meters)	Walking (W)	Bicycle (B)	Motor cycle (MC)	W&B	W&MC	B&MC	Total
2001-2100	0	1	10	0	0	0	11
2101-2200	0	0	8	0	0	0	8
2201-2300	0	0	8	0	0	2	10
2301-4400	0	0	46	0	0	1	47
>4400	0	0	11	0	0	0	11
Total	139	13	285	6	13	7	463

Source: Analysis Results, 2024

Walking Distance

The walking distance of students of SDN 03 Pasir Putih Sawangam Depok, measured based on the distance between school and residence (based on address) From the table, it can be seen that the mode of transportation to and from school on foot is chosen by students at a distance of 800 meters, and as many as 139 out of 463 students walk. The walking distance of students of SDN 03 Pasir Putih Sawangam Depok with the age range of 6-13 years old and the percentage of students who have a walking distance is presented in Figure 4. The walking distance that can be reached by 50% is 328 meters, with the shortest distance being 50 meters and the longest being 800 meters, the details of the calculation of walking distance are presented in the following table and figure.

Walking Distance and Percentage of Students Who Can Reach it

walking distance (m)	n	%	% of students who can reach
50	3	2%	100%
150	28	20%	98%
250	49	35%	78%
350	33	24%	42%
450	19	14%	19%
550	1	1%	5%
650	4	3%	4%
750	2	1%	1%
>800	0	0	
Total	139		

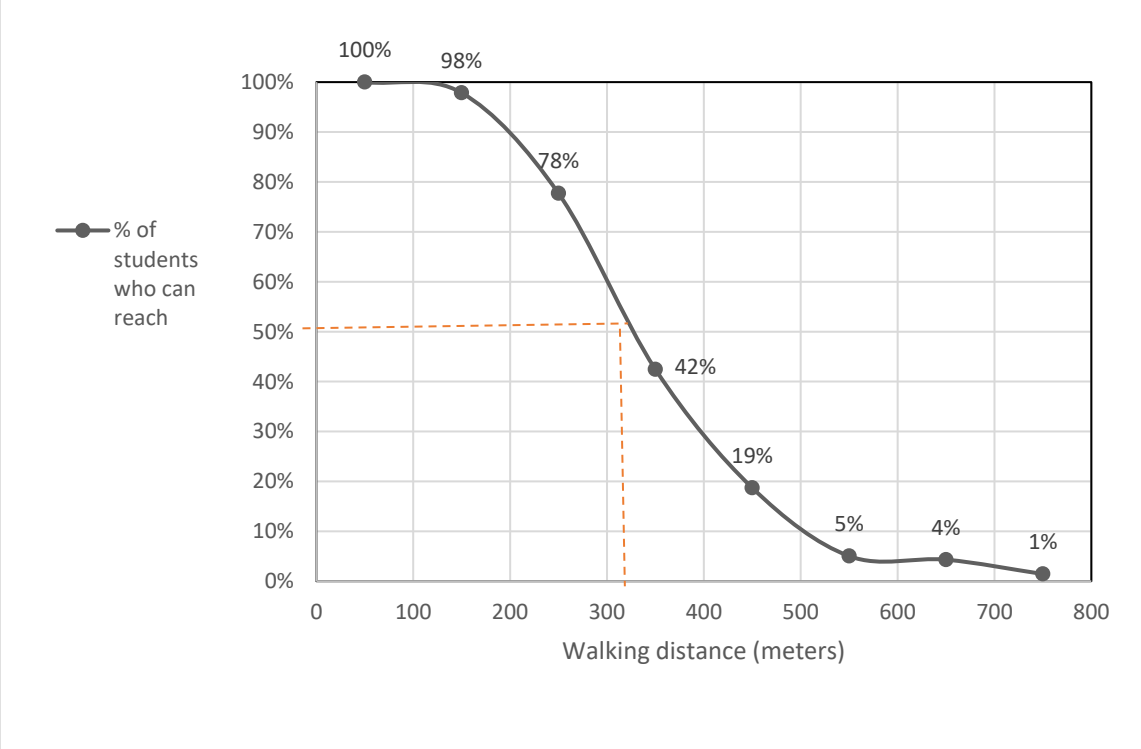
Source: Analysis Results, 2024

Table 8. Walking Distance of Students 03 Pasir Putih Sawangam Depok

Distance from home to school (m)		n	center value x distance
range	Center Value		
1-100	50	3	150
101-200	150	28	4200
201-300	250	49	12250
301-400	350	33	11550
401-500	450	19	8550
501-600	550	1	550

Distance from home to school (m)		n	center value x distance
range	Center Value		
601-700	650	4	2600
701-800	750	2	1500
total		139	41350
minimum distance (m)		50	
Maximum distance (m)		800	
average (m)		297	

Source: Analysis Results, 2024



Walking Distance and Percentage of Students 03 Pasir Putih Sawangan Depok Who Are Able to Walk.

Source: Analysis Results, 2024

Implementation of Walking to School Program (Ngabaso) at SDN Pasir Putih 03, Sawangan, Depok.

The implementation of Ngabaso activities that aim to familiarize children with walking at SDN Pasir Putih 03, Sawangan, Depok is proposed as follows:

- Location: 100 meters south of SDN 03 Pasir Putih Sawangan Depok
- Number of students participating : 644 students
- Number of students who switch modes of transportation: 643-139 = 504 motorcycles and 1 car (assuming gasoline fuel)

- Time to walk together: 6:45 a.m.

Figure 6 Location of the starting point of the program Walking with Students of SDN Pasir Putih 03, Sawangan, Depok to School
Source: Analysis Results, 2024

With CO emissions by vehicle type during the arrival time to school (assumed to be 1 hour / 06.00-07.00), the total CO exposure that can be reduced is 0.75 g. Details of the calculation of reduced exposure to CO emissions on Pasir Putih road, at a distance of 100 meters south of SDN Pasir Putih 03, Sawangan, Depok are presented in Table 9,

Table 9. Reduced exposure to CO

Mode of Transportation	CO (g/km)	CO (g/m)	Number of vehicles at 100 meters	Reduced exposure to CO (g- 60 min)
139				
Motorcycle	14	0,014	504	0,71
Car (gasoline)	40	0,04	1	0,04
			Total	0,75

Source: Analysis Results, 2024

Benefits of Walking to School (Ngabaso) Program Implementation in Depok City

The benefits of implementing the Walking to School Program (Ngabaso) in Depok City are known from the reduction in CO exposure due to students going to school using motorized transportation modes (motorcycles and private cars) with initial assumptions based on research results at SDN Pasir Putih 03, Sawangan, Depok, as follows.

The assumptions used are:

- Gathering point location: 100 meters away from the School premises
- Number of participating schools: moderate scenario i.e. 50% of elementary schools (public & private) per sub-district in Depok city (Table 1) and no increase in the number of schools throughout 2021-2023.
- Number of participating students: 50% of Primary Schools (Public & Private) based on the number of students per sub-district in Depok city.(Table 1) and no increase in the number of students throughout 2021-2023.
- Number of students who switch modes of transportation: Based on the proportion of study results aggregated in the following Table:

Table 10. Assumed Proportion of Transportation Modes to School Used by Primary School Students in Depok

	Walking	Bicycling	Motor cycle	car	Total
%	30%	3%	62%	5%	100,00 %

- Observation time: 60 minutes (come to the gathering point 06.00-06.45, enter the school at 07.00)
- Number of school days in 1 year: 200

Based on the above assumptions, the calculation of the estimated CO exposure reduced by the walking program with elementary school students in Depok City at Pk. The estimated CO emissions due to motor vehicles used by elementary school students in Depok City at 06.00-07.00 at a distance of 100 meters from the school location that can be reduced because elementary school students walk to school together is 430,870 grams/day or 87 kg/year. With moderate assumptions, the Walking to School (Ngabaso) program in Depok City can be increased to an optimistic scenario (75% of schools participating) so that air quality improvements, especially CO reduction in Depok City, can be more significant.

Table 11: Reduced CO exposure due to the Walking Program with Depok City Elementary School Students at Pk. 06.00-07.00

	No. of . School			Students (x1000)			Mode of transportation (public & private) \				L total (meters)	CO (gr)		
	Public	Private	Total	Public	Private	Total	Walking	bicycle	Motor-cycle	car		Motor-cycle	car	Total
Sawangan	11	10	20	4,209	1,576	5,785	1736	174	3587	289	2000	10043	23140	33183
Bojongsari	7	10	17	3,653	1,7415	5,3945	1728	162	3272	233	1700	7786	15857	23644
Pancoran Mas	12	15	27	6,917	4,449	11,366	3617	341	6909	499	2700	26114	53906	80020
Cipayung	7	9	16	4,2105	2,7095	6,92	2202	208	4206	304	1550	9127	18841	27969
Sukmajaya	16	12	28	7,5325	3,239	10,7715	3457	323	6528	463	2750	25132	50958	76089
Cilodong	9	7	16	4,8075	2,169	6,9765	2237	209	4229	301	1550	9178	18647	27824
Cimanggis	11	13	24	6,182	3,512	9,694	3094	291	5887	423	2400	19779	40596	60376
Tapos	15	9	24	7,847	1,699	9,546	3099	286	5762	399	2350	18956	37490	56446
Beji	9	7	16	4,3635	1,746	6,1095	1964	183	3701	262	1600	8289	16758	25047
Limo	5	8	12	2,5375	1,794	4,3315	1376	130	2635	191	1200	4426	9178	13604
Cinere	4	5	9	1,587	1,3855	2,9725	939	89	1811	133	850	2155	4514	6669
Depok City	104	103	207	53,8465	26,0205	79,867	25449,225	2396,01	48524,79	3496,975	20650	140985,8394	289884,32	430870,16

CONCLUSIONS

The implementation of the walking to school program at a distance of 100 meters to school is very appropriate in addition to improving student health and improving air quality during school hours. The estimated reduction in CO emissions under the moderate scenario for 1 hour in the morning along the distance between the gathering point and the school (100 meters) in Depok city is 431grams/day or equivalent to 87 kg/year.

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