Understanding School Travel Behavior and the Impact of Awareness Raising to Promote Resilient Public Bus System in the Coastal City in Indonesia: A Case of Semarang city

S. B. Nugroho[1], E. Zusman, R. Nakano, J. Fujino, H. S Huboyo; W. Handayani and M. Anggraeni

ABSTRACT

In fast-growing coastal cities, dependable public transport, diversity of modes, and social inclusion are among several factors that contribute to resilient transport. However, these factors depend critically on whether key ridership segments are aware of the benefits of public transport. This article describes the effects of an awareness-raising campaign intended to encourage junior high school students to use public transport in Semarang, Indonesia. The article analyses the campaign's impact by comparing student responses to a survey on the use of the bus system for school trips before and after the campaign in three junior high schools in Semarang. The survey demonstrated that, though a diversity of modes exists for school trips, parents often influence student mode choices. For some respondents, parents preferred family drop-offs and online taxi pick-up services to public transport. However, the public bus or quasi-bus rapid transit (BRT) (known as Trans Semarang) may hold the potential to increase student mode share because it offers comfort, security, opportunities to socialize as well as discounted student prices. Encouraging a modal shift from private to public transport for school may improve urban transport resilience. However, a lack of public bus infrastructure remains a sizable hurdle to this worthy objective.

Keywords: School Travel, Behavioural change, Junior High School, Trans Semarang, Coastal City

1. INTRODUCTION

The concept of resilience was introduced into environment studies in the early 1970s in relation to the capacity of ecosystems to return to their initial states when subjected to disruption (Holling, 1973). Urban resilience has emerged to frame how actors and infrastructure in urban areas contribute to the capacity to survive, respond, recover, adapt and evolve in reaction to chronic and acute stresses and events that disrupt systems and practices (Ward, 2019). Embedding resilience into complex urban systems and their environments is a priority (e.g. Semarang City Government, 2016; Buteler et al.2016; Ahern, 2011; Staddon, 2010). Resilience is also being incorporated in multiple frameworks related to urban studies and analysis focusing on the practicalities of embedding resilience across the socio-ecological-technical (SET) system (Ribeiro and Goncalves, 2019).

Studies focusing on transport system resilience began in the 1990s (Comfort, 1994). Recently, the United Nations Sustainable Development Goals (SDGs) aims to create more inclusive, safe, resilient, and sustainable cities (United Nations, 2015). Providing safe access, affordable, accessible and sustainable transport systems for all citizen groups by expanding public transport services is one target listed under the sustainable development goals on building sustainable cities. This SDG target generally includes more efficient public transport systems and reduced private vehicle dependency for urban mobility (Zhao, 2010). Transport policies analysis targeting the development of better urban infrastructures and its operational performance can increase urban resilience in the long term (Leung et al, 2017). The multimodal transport system, and developing alternatives to private vehicle use by enhancing public transportation and non-motorized transport, are proposed as two elements for resilient urban transport principles (Khodabaksh et al, 2015)

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[1] Corresponding author

The intervention aiming to encourage a modal shift from private to public transport among students and ensure safe travel can help improve urban transport resilience in coastal cities. First, young students are often the largest group of public transport users in a city (IUCCE, 2018). Second, mobility attitudes are deeply influenced by experiences at an early age (Canters et al, 2015) and behavioural interventions for young adolescents between the ages of 12 and 14 represent a "transition phase" between childhood and adulthood. It is therefore more effective compared to older target groups (Stark et al, 2018). A pro-private vehicle orientation seems to be acquired from the age of 12 and increases as people get older (Flade & Limbourg, 1997). Some positive impacts on travel behaviour may become evident after teenagers reach adulthood and can make their own independent decisions on their preferred transport mode.

Although young people often dominate public facilities in developing countries, there has been little engagement on strategies promoted in the name of resilience involving the younger generations as key stakeholders (D. McKoy, 20145). Young people, especially those who come from low-income groups, are rarely invited to sit at the urban planning and policymaking table (Simpson, 1997). Engagement of young people who are usually insecure and highly vulnerable to shocks and stresses (both climate- and non-climate-related) has a strong link to resilience on urban mobility systems. Travel behaviour when going to school and interventions on this behaviour have been widely discussed in Europe and North America, but there is limited empirical information about similar engagement in developing countries. This knowledge gap is particularly problematic in developing countries where the most climate vulnerable towns and cities are concentrated (Revi et al. 2014; Sanderson 2000).

This article aims to close that gap by drawing attention to the importance of understanding school travel behaviour among the youth. It then looks at awareness-raising programs that encourage the modal shift from private to public bus systems as part of an effort to boost transport resilience in Semarang, Indonesia. To support these aims, this research applies widely-used intervention analysis wherein a before-after control group experiment and surveys are used to understand changes in student mode choice preferences at three junior high schools in Semarang, Indonesia (Stark, et al, 2018).

As a first step, a baseline survey was carried out for a large proportion of students before the awareness-raising program. Following this, a post-training survey was carried out for selected participants and non-participants of the awareness-raising program among respondents to the baseline survey. The study found a variation in the total number of passengers on the public Trans Semarang quasi-bus rapid transit (BRT) system due to school holiday seasons and weather conditions. However, Trans Semarang is a promising mode because it offers comfort, security, social connectivity as well as discounted student prices. Trans Semarang is arguably even more important for schools located in a flood zone. The study confirmed an increased willingness to use Trans Semarang after the awareness-raising program. However, insufficient public bus services and infrastructure were identified as the main barrier to shift from private vehicles. Prepaid cards to facilitate non-cash transactions, and sharing information through social media, helped to increase the understanding, evaluation and consequently the use of Trans Semarang for school travel. This research is an important input for the city's government to improve its adaptation strategy in response to climate-related changes such as extreme weather.

The remainder of the article is divided into four sections. The next section reviews literature on raising awareness. The section thereafter describes the study location and provides baseline information. A fourth section presents key results. A final section concludes with a discussion of areas for future research.

2. LITERATURE REVIEW AND METHODOLOGY

Travel behaviour and Urban Transport Resilience

Understanding how travel behaviour change can help policymakers to improve urban transport resilience (Kellen et al, 2011; Liu et al, 2018; Abad and Fillone, 2019, Liu et al, 2017). Disruptive events are usually a central theme of studies on urban transport resilience addressing network disruptions,

economic and energy impacts, natural disasters, and more recently, human-induced disasters and terrorist attacks (D'Lima and Medda, 2015; Hong et al, 2019; Fernandes et al, 2019; Santos, et al, 2020; Cox et al, 2011; Chan and Schofer, 2016; Donovan and Work, 2017). In the last few decades, there have been increased studies to investigate individual travel behaviour in response to disruptive events (Abad et al, 2019; Abad and Fillone, 2017; Sunga et al, 2017). Risk perception is a key determinant of individual adaptation behaviour (Arnell and Delaney, 2006; Moser and Leuers, 2008; Hoffman et al., 2009; Li et al, 2017). The transportation risk perception in urban populations may change over time, but people consistently assessed the risks related to private motorized transportation as higher than corresponding risks in public transportation (Lund et al, 2016). The risk-related factor is believed to be associated with the likelihood of using public or private transportation (Nordfjaern et al, 2014). Some local authorities in European cities sought to increase public transport use by providing a higher frequency of better quality and less expensive public transport options (Mocca, 2015)

Encouraging a modal shift through an awareness-raising program for young people in Semarang city

The share of public transport mode in Semarang city is small compared to private vehicles. However, the number of students who use public transport gradually increases every year (IUCCE, 2018). There are five steps to encourage modal shift from private vehicle to public transport modes for school travel (Jones and Sloman, 2003). Those five steps are as follows: (a) awareness of the problem; (b) acceptance of the need for change; (c) changing attitudes toward alternative modes; (d) initiating action to reduce private vehicle use and (e) assimilation of new behaviour into everyday life. Another European-funded project on education for sustainable transport, called TAPESTRY, developed the "seven stages of change" travel behaviour model by combining the Theory of Planned Behaviour and the Trans-theoretical model. The seven stages consist of the following steps: (a) awareness of key issues; (b) accepting responsibility/ acknowledging relevance; (c) perception of options; (d) evaluation of options; (e) making a choice; (f) experimental behaviour and (g) habitual behaviour (Jones and Sloman, 2003). Steps five and seven emphasize the importance of a phased approach, with awareness as the basic or initial step. The education and awareness attainment of the young generation had various results. There was substantial variation in the ability of individuals to undertake adaptive capacity (Smit and Wandel, 2006; Brooks et al, 2005; Gallopin, 2006). However, the accumulation of knowledge and information received by a person makes them more aware of hazards and improves their risk perception (Qasim et al, 2015).

The awareness-raising program has several goals to improve knowledge on safety-related aspects for daily travel going to and from school; and to encourage a modal shift for travel to and from school by using Quasi-BRT Trans Semarang bus system. The hope is that children can be self-motivated to continue using public transport. The intention to use, and frequency to use, Trans Semarang would be used as indicators to observe behavioural change among students. The frequent use of buses could be categorized into several levels, from "never use" to "use very often". The ordered logit model that is used to observe the changes in people's decision to upgrade vehicle ownership level (Dargay and Hanly, 2007) is suitable to capture the frequency to use bus for school travel. The ordered logit model uses the formula as follows:

$$y^* = \beta'\mathrm{x} + \varepsilon, \qquad\qquad (1)$$

$$Y = \left\{ \begin{array}{ll} 0 & \text{if } y^* \leq \mu_1, \\ 1 & \text{if } \mu_1 < y^* \leq \mu_2, \\ \vdots & \\ \mathrm{N} & \text{if } \mu_\mathrm{N} < y^* \end{array} \right. \qquad\qquad (2)$$

where y^* represents the observed responses of the possibility to use public bus Trans. The **β** is vectors of parameters, **x** is vectors of independent variables associated with the students. The μ is threshold value that divides a continuous joint distribution of error terms ε into intervals associated with different levels of frequency use of Trans Semarang (y=0 (never use); y=1 (very rarely); y=2 (rarely); y=3 (often); y=4 (very often)). The ordered logit model was developed by considering: (a) individual attributes: grade level and gender; (b) distance from home to the nearest bus shelter; (c) distance from school to the

nearest bus stop; (d) how they have come to know about Trans Semarang; (e) existing mode for going to school trip; (f) perceived opinion on the barrier and merits of Trans Semarang.

3. STUDY LOCATION AND DATA

Semarang city and its public transport system

Semarang is the capital city of Central Java Province, located around 450 km east of the capital city, Jakarta, and between the two main cities on Java Island, Jakarta and Surabaya. It is the fifth largest city in Indonesia with a total population of 1,674,358 (as of December 2019) and a total area of more than 370 square kilometres. The gross regional domestic product (GRDP) per capita is USD 6,461.5 (USD1= IDR 13,000) and the largest contributor to GRDP is the secondary sector, including manufacturing, food, beverages and tobacco, chemical and pharmaceuticals, and other industries such as textiles and transport equipment (IGES, 2017). Urban mobility in Semarang relies heavily on road transport and the majority of people use private vehicles (80%) with only 20% using public transport. The main roads are dominated by motorcycles (58%), private cars (22%) and public transport (20%) (GCF, 2018). The share of public transport consists of angkots (minibuses) (50%), the quasi-BRT (Trans Semarang) (40%) and regular buses (10%). The angkots and regular buses cover 88 routes served by 1766 angkots and 83 regular buses. Trans Semarang has adopted an all-BRT standard without a dedicated lane and still uses mixed traffic lanes, sharing the road with other modes. It covers eight main routes served by 144 buses and two feeder routes served by 44 buses (as of December 2019). Although the share of public transport modes in Semarang is small compared to other private vehicles, the largest group of public transport users usually are young people and students (IUCCE, 2018). The number of student passengers on Trans Semarang has increased steadily year on year (See Figure 1a).

The Semarang government developed Trans Semarang in an effort to provide better public transportation that is safe, resilient, comfortable, and affordable for citizens. The bus system is expanding and expected to ply all 12 corridors by 2021. Even though Trans Semarang is a good initiative and has a good performance track record, there is still ample scope for improvement. Such improvement will arguably encourage people to shift from private vehicles to public transport. Based on the 2016 survey, the majority of BRT users (51%) were formerly regular angkot and bus users (IGES, 2017). Without a rearrangement of the route, many angkot and regular buses overlap with Trans Semarang and lose their passengers. There are around 15 public transport routes that overlap more than 20% with corridor 1 of Trans Semarang. This means that more vehicles are on the road with a low occupancy. Therefore a comprehensive public transport system is needed, not only to enable effective and efficient mobility, but to reduce vehicle use. Such changes would potentially lead to a resilient and environmentally-sustainable mobility system.

Passenger of Trans Semarang and Its Variations

There has been a gradual expansion of the coverage area of Trans Semarang through the additional routes and corridors, from one corridor at the beginning of operations in May 2009 to 10 corridors (8 corridors & 2 feeder corridors) in 2020, resulting in an increased number of total annual passengers. The total number of passengers using Trans Semarang grew from 371,336 passengers in 2010 to about 11,308,912 passengers in 2019 or more than 30 times within 10 years of operations (Figure 1a). The special pricing policy from the city government for students and elderly passengers made Trans Semarang more popular for school travel (include university students) (Figure 1b). As a result, over the last five years students have grown to make up around 35% of the total passengers (2015-2019). The highest passenger volume of Trans Semarang is around 2677 passengers per hour per direction in corridor 1 — a passenger volume that rivals Beijing or Islamabad (ITDP, 2018).

An overview of the variation in numbers of total monthly passengers reveals a typical decrease in numbers during the school holiday seasons (June – July & December) every year. The total number of passengers in June is the lowest compared to other months (Figure 1c).

Baseline Survey

The awareness-raising campaign featured in this article was carried out at three junior high schools in Semarang: school no. 1 (SMP 1); school no. 7 (SMP 7) and school no. 31 (SMP 31) considering the accessibility to Trans Semarang corridors and its locations. Two schools are located near bus corridors (SMP 1 and SMP 7) while the other school (SMP 31) represented a control location without access to a bus corridor. There is a bus shelter in front of SMP 7 served by six out of seven corridors (bus corridors no. 1,2,3,4,5 and 7) making it the most accessible from all directions. The SMP7 is also located in the city center around 600 meters from the city hall in the central business district. The SMP1 is served by three out of seven corridors of Trans Semarang (corridors no. 1, 4 and 5) but the nearest shelter was around 300 meter from school. The SMP1 is located slightly outside the city center but is still within a radius of less than 5 km from the city center. The SMP31 is located in a residential sub-urban area around 8 km from the city center and a long way from any bus route—about around 1.5 km from the school. Due to limited resources, only three schools were selected for this research.

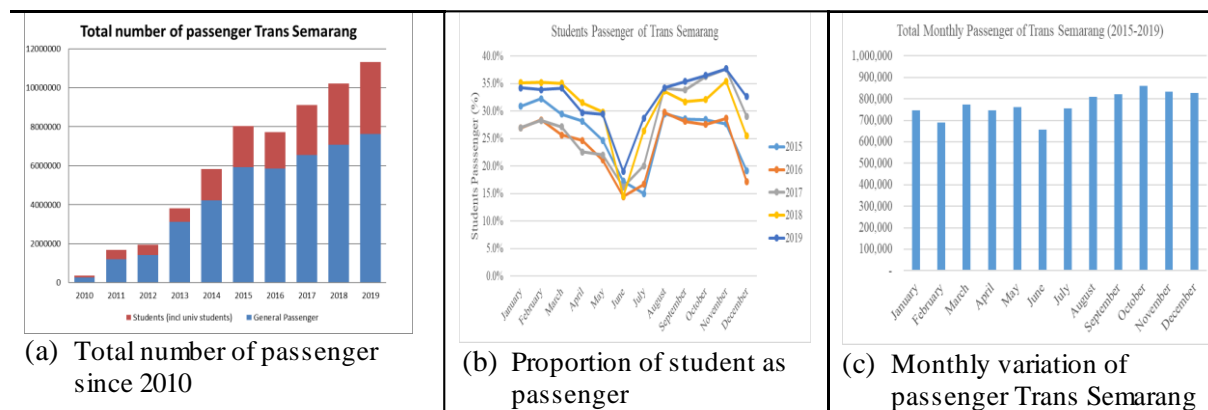| (a) Total number of passenger since 2010 | (b) Proportion of student as passenger | (c) Monthly variation of passenger Trans Semarang |

Figure 1 Profile and Seasonal Variation of Passenger of Trans Semarang

Two surveys were conducted within a three-month interval to evaluate the effect of awareness-raising among participants and non-participants. The baseline survey was performed through an online survey targeting all three school in October 2017. The baseline survey gathered basic information on several issues such as: (a) understanding traffic safety; (b) recognition levels of Trans Semarang; (c) comprehension for Trans Semarang; (d) travel modes for school travel; and (e) the perceived evaluation on barriers and benefits of using Trans Semarang for daily activities. Participation in the survey was on a voluntary basis for all three grades at the surveyed junior high schools. The sample size was 857 students or approximately 38% of the total population. The questionnaires were distributed to all three grades at each school and the largest sample of around 39.8% was obtained from grade 2, while the other remaining two grades (grade 1 and grade 3) were around 30%. Larger sample sizes were obtained from two schools (SMP 1 and SMP 7) while SMP 31 representing a control school comprised 21.3% of the sample. About 55.4% of the students participating in the baseline survey were female.

Table 1 Sample Distribution (Baseline Survey and Post Training Survey)

Sample Size by School	Total all Grade		Grade 1		Grade 2		Grade 3	
	N	%	N	%	N	%	N	%
A. Baseline Survey								
SMP1 (School 1)	350	40.8%	132	15.4%	132	15.4%	86	10.0%
SMP 7 (School 2)	335	39.1%	114	13.3%	116	13.5%	105	12.3%
SMP 31 (School 3) (Control/far from bus shelter)	172	20.1%	17	2.0%	84	9.8%	71	8.3%
Total Sample Size	857	100%	263	30.7%	332	38.7%	262	30.6%
B. Post Training Survey	P	Non- P	P	Non- P	P	Non- P	P	Non-P
SMP1 (School 1)	26	14	3	4	23	10	0	0
SMP 7 (School 2)	30	11	9	1	12	1	9	9
SMP 31 (School 3) (Control/far from bus shelter)	21	23	7	3	10	5	4	15
Total Sample Size	77	48	19	8	45	16	13	24

Note: P: Participants & Non-P: Non-participant

The baseline survey measured the level of student's recognition of Trans Semarang (Table 2). Less than 10%of students knew about the Trans Semarang, while more than half of students knew about Trans Semarang in general. However, around 35% of students knew more detailed features of Trans Semarang such as (a) total corridors; (b) the role of bus shelters; (c) student discounts on weekdays etc. Around 70.3% of the surveyed students acquired this information about Trans Semarang from direct observation; this was especially the case for schools located nearby or served by the buses. Social media was the second most common channel through which students learned about the system; this channel played a key role in the suburban school. More than 28% of students recognized the shelter near their house.

Table 2 Knowledge about Trans Semarang & daily travel patterns

No	Variables	All Schools		SMP 1 & SMP 7		SMP 31	
		Freq	%	Freq	%	Freq	%
1	**Knowledge about Trans Semarang BRT**						
	a. Don't know	86	10.0%	77	11.2%	9	5.2%
	b. Know in general	465	54.3%	371	54.2%	94	54.7%
	c. Understood in more specific (example: routes, shelter, pricing for students, etc)	295	34.4%	228	33.3%	67	39.0%
	d. Understood very well (almost all aspects of BRT)	11	1.3%	9	1.3%	2	1.2%
2	**Source of Information (Multiple answer)**						
	a. Direct observation (see it every day)	641	71.1%	533	74.9%	108	57.1%
	b. Social Media	134	14.9%	76	10.7%	58	30.7%
	c. Newspaper, bulletin, leaflet	41	4.6%	32	4.5%	9	4.8%
	d. Family, Friend or Network	39	4.3%	35	4.9%	4	2.1%
	e. Others	13	1.4%	7	1.0%	6	3.2%
	f. No response	33	3.7%	29	4.1%	4	2.1%
3	**Shelter near house**						
	a. Yes	524	58.8%	408	58.2%	116	61.1%
	b. No	333	37.4%	277	39.5%	56	29.5%
4	**Distance from home to nearest shelter (m)**						
	a. < 500 m	253	28.4%	198	28.2%	55	28.9%
	b. 500.01 - 1000 m	181	20.3%	151	21.5%	30	15.8%
	c. 1000.01 - 1500 m	78	8.8%	59	8.4%	19	10.0%
	d. > 1500 m	92	10.3%	77	11.0%	15	7.9%
	e. Don't know	253	28.4%	200	28.5%	1	0.5%

Source: Author's survey

Daily school travel patterns in Semarang city

Most students use different modes for going to and from school, and only a quarter of students use similar modes for both trips (Table 3). Most students who used a drop-off service used a different mode for returning home, such as an online ride-hailing motorcycle taxi system, Trans Semarang, or walking home from school. In contrast, many motorcycle users use the same mode of transport to return home from school. A similar pattern was also observed for users of Trans Semarang. While Trans Semarang plays a significant role for returning home from all schools, the role of non-motorized modes was important for travelling to school. Further, walking was the preferred non-motorized mode in the suburban school. Bicycles are preferred for students at schools located in the city center and surrounding areas. The proportion of students walking home from school increased to 33.8% in suburban areas and was even higher in the city center. This suggests the important role and flexibility of non-motorized transport (bicycle and walking) as a mobility option. The use of motorcycles was higher in the suburban school.

Yet another finding from the survey involved the strong dependence of student mode choices on parents and relative travel patterns. Drop-off services from parents, family members or relatives often delivered

students to school. However, the pick-up/drop off services were not often feasible for return trips due to mismatched schedules between school and work. Instead, online taxis that provide a point-to-point service similar to the family drop-off service were often preferred to return home (Nugroho, 2019). The use of the online taxi system tends to be more popular and increase slightly in the city center.

Table 3 Modal Shift of school trips, from going to & return from school

To School/ From School	Walking	Motorcycle	BRT	Shared Taxi	Pick-up & Drop off	Bicycle	Other public transports (Minibus, etc)	No answer / missing data	Total
Walking	**2.6%**	0.4%	0.3%	0.2%	1.0%	0.3%	0.4%	0.0%	5.2%
Motorcycle	0.4%	**10.1%**	1.5%	1.0%	2.0%	0.4%	1.1%	0.0%	16.6%
BRT	0.3%	1.5%	**7.5%**	0.9%	3.3%	0.1%	2.7%	0.0%	16.4%
Shared Taxi	0.2%	1.0%	0.9%	**3.8%**	3.0%	0.2%	1.1%	1.0%	11.2%
Pick-up & Drop off	2.0%	3.3%	3.0%	18.0%	**0.9%**	3.0%	0.0%	0.3%	**30.6%**
Bicycle	0.4%	0.1%	0.2%	0.9%	2.8%	**0.1%**	0.0%	0.4%	4.9%
Other public transports (Minibus, etc)	1.1%	2.7%	1.1%	3.0%	0.1%	6.5%	**0.0%**	0.0%	14.5%
No answer/ missing data	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	**0.0%**	0.5%
Total	7.1%	19.1%	14.6%	**28.0%**	13.1%	10.7%	5.7%	1.7%	1

Source: Author's survey & calculation.

Perceived Perception on the merits and barriers of using Trans Semarang

The survey found around 44% of students do not face any barriers to using Trans Semarang. Moreover, the suburban school had the fewest barriers compared to the other schools. In fact, the largest barrier is insufficient coverage service of Trans Semarang. The existing eight corridors and two feeder corridors are not enough to cover all areas within the city. Hence, students continue to use private vehicles (Table 4). The mismatch in schedules between school and work is another important barrier for students in the suburban area. Affordable fares are the main merit of Trans Semarang because the government offers a special pricing scheme (discount) for students on weekdays of about 1000 rupiah (7 US cents, 1 USD=14000 rupiah), which is equal to 28% of the normal fare for regular passengers. The bus service is comfortable and convenient because buses have air conditioning for hot weather in the dry season and humid conditions in the wet season.

While Trans Semarang has many desirable features, there were also some drawbacks and downsides, including overcrowding. A sharp rise in demand occurs when school finishes; bus operators have tried to address this issue with rescheduling to reduce headway during peak demand periods. However, crowding persists and may require additional attention moving forward. Some of the challenges involved only one of the schools. For example, distance to the bus shelter is a problem associated with the suburban school (9.1%). In all of the schools, the majority of students believe that social media (Instagram, Facebook and Twitter) is the most appropriate approach for raising awareness of the bus program.

Table 4 Perceived evaluation on BRT Trans Semarang

No	Variables	All Schools		SMP 1 & SMP 7		SMP 31	
		Freq	%	Freq	%	Freq	%
1	Barrier to use BRT						
	a. Odd Route (not covered by bus route)	190	20.1%	152	21.7%	38	20.0%
	b. Odd Schedule (mismatch schedule)	23	2.4%	12	1.7%	11	5.8%
	c. Expensive Ticket	2	0.2%	2	0.3%	0	0.0%
	d. Not comfortable and not convenient	35	3.7%	32	4.6%	3	1.6%
	e. Not safe (security aspect)	4	0.4%	4	0.6%	0	0.0%
	f. More comfortable with private vehicles	112	11.9%	99	14.1%	13	6.8%
	g. Others	76	8.0%	72	10.3%	4	2.1%
	h. No barrier (already use it)	415	43.9%	312	44.5%	103	54.2%
2	Merits/Benefits to use BRT (multiple answer)						
	a. Price is cheap	604	34.7%	483	35.4%	121	32.2%
	b. Comfortable (with air conditioning, etc)	376	21.6%	289	21.2%	87	23.1%
	c. Punctuality (schedule)	42	2.4%	29	2.1%	13	3.5%
	d. Secure (security aspect)	185	10.6%	139	10.2%	46	12.2%
	e. Social Fabric (ride together with friends)	180	10.3%	132	9.7%	48	12.8%
	f. Closed to the shelters	169	9.7%	153	11.2%	16	4.3%
	g. Other reason	20	1.1%	20	1.5%	0	0.0%
	h. Don't answer	107	6.1%	89	6.5%	18	4.8%
3	Problem related on Boarding and Alignment (multiple answer)						
	a. Distance in between shelters is too far	64	6.8%	45	6.1%	19	9.1%
	b. Crowded in the bus (load factor is high)	290	30.7%	243	33.0%	47	22.5%
	c. Short interval of stop	58	6.1%	49	6.7%	9	4.3%
	d. Don't know how to ride	14	1.5%	14	1.9%	0	0.0%
	e. Others	26	2.8%	23	3.1%	3	1.4%
	f. No Barrier	370	39.2%	283	38.5%	87	41.6%
	g. Don't answer	87	9.2%	62	8.4%	25	12.0%
4	Method for awareness raising campaign (multiple answer)						
	a. Social Media (Instagram, Facebook, etc)	627	50.0%	495	49.9%	132	60.3%
	b. Wall magazine at school	158	12.6%	134	13.5%	24	11.0%
	c. Hard copy: Newspaper, Magazine or Leaflet/Pamphlet	140	11.2%	114	11.5%	26	11.9%
	d. Formal education (course inside class)	185	14.8%	146	14.7%	39	17.8%
	e. Others	53	4.2%	47	4.7%	6	2.7%

	f. Don't Answer	43	3.4%	32	3.2%	11	5.0%
5	Frequency to use BRT						
	a. Never	159	18.6%	126	18.4%	33	19.2%
	b. Very rarely	128	14.9%	116	16.9%	12	7.0%
	c. Rarely	233	27.2%	184	26.9%	49	28.5%
	d. Often	224	26.1%	172	25.1%	52	30.2%
	e. Very often	113	13.2%	87	12.7%	26	15.1%

Source: Author's survey.

Understanding student's travel behaviour on the public bus Trans Semarang

An ordered logit model was used to determine which factors influence the frequency of bus use among the surveyed students. As shown in Table 5, the model was calculated using the software LIMDEP (NLOGIT) (Greene, 2002). In developing the model, the first step was examining whether there were any differences in the use of Trans Semarang across different schools. The frequency of use of Trans Semarang was differed significantly between the reference school (SMP31) and the others (SMP1 and SMP7). Although SMP1 and SMP7 are located in the city center, the frequency of bus use is significantly lower than students in the suburban school (SMP31). The estimation result also confirmed that Trans Semarang played a more important role for school travel among students in the flood hazard area (SMP31)—an important finding with implications for resilience.

The model could also help evaluate the impacts of other factors on the use of Trans Semarang. For instance, the model showed that usage pattern remained consistent across grades. However, female students and students who depended on the drop-off service tended to avoid the bus. Another set of potentially important factors involved the built environment. In the survey, one way this possibility was examined involved looking at the distance to the nearest bus shelter to the house. The frequency of using the bus increased significantly if the bus shelter was located less than 1000 meters from the home. However, the built environment surrounding schools was not significant variable.

How information on bus services is obtained is another influential variable associated with the perception and opinion about the bus services. When students observe bus services directly, this improves their motivation to use the service. The perception on the merits of Trans Semarang, such as affordable ticket prices and comfort to deal with hot and humid weather, had a positive and significant influence on the estimation results. In contrast, the evaluation on the service coverage and bus frequency had a negative and significant influence on frequency use of Trans Semarang. Looking at model performance, the threshold value (μ) that divides a continuous joint distribution of error terms ε into intervals associated with different levels of possibility is substantively and statistically significant in the estimation results. The constant term μ represent the threshold parameter between all levels is clear and significant. This suggests that the model fits the survey data well.

Table 5 Estimation results of ordered logit model

Variables	Beta (t-score)
Constant	1.434 (4.599)***
Student's Attributes	
Female	-0.400 (-3.041)***
Grade – 2	0.060 (0.363)
Grade - 3	-0.175 (-0.992)
School Location (SMP 31 as reference)	
School 1 (SMP No 1 – City Center)	-0.580 (-2.270)**
School 2 (SMP No 7 – Within city boundary)	-0.615(-2.395)**
Built Environment	
Distance from home to nearest bus shelter less than 500 m	0.606 (3.737)***
Distance from home to nearest bus shelter 501 – 1000m	0.758(4.3710)***
Distance from school to nearest bus shelter less than 500 m	0.341(1.431)
Distance from school to nearest bus shelter 501 – 1000m	0.385(1.418)
The way to get information about Trans Semarang	
Direct observation	0.549(2.759)***
Through social media (Facebook, Instagram, twitter, etc)	0.017 (0.075)
Going to school by drop-off service by family	-0.465(-3.530)***
Barrier to use public Transport	
Barrier relate coverage area of bus service	-1.460(-8.836)***
Barrier relate to odd schedule between bus and school	-0.866(-2.140)**
Opinion about benefit of Trans Semarang	
Cheap fare ticket	0.932 (6.106)***
Comfortable because of air conditioning system inside the bus & shelter	0.396(2.904)***
Problem on boarding and alignment due to distance between station	0.196 (0.770)
Threshold parameter for index (μ)	
μ (1) (between Y=0 and Y=1):	1.060 (15.125)***
μ (2) (between Y=2 and Y=3)	2.502 (31.903)***
μ (3) (between Y=3 and Y=4)	4.302 (38.173)***
Model's Attributes	
Degree of Freedom	17
AIC	2.879
BIC	3.001
Mc Fadden Pseudo R-squared	0.099

Source: Author's calculation

4. AWARENESS-TRAINING PROGRAM AND RESULTS

Awareness-raising program

The awareness-raising program consisted of four main phases:

1) Planning activities in collaboration with multiple stakeholders. First, a cross-sectoral discussion was held together with relevant institutes and organizations in October 2017. Second, materials were designed and developed for raising awareness of Trans Semarang. There were several relevant stakeholders involved in the program, including: the City Planning Department, Education Department, Chairman of Junior High Schools, Parents Association, Local Police Department, Transport Authority; and the operator of Trans Semarang. Following the discussions between these different groups and organizations, the team developed materials for the program, including: (a) modules and (b) leaflets on how to ride the bus. The modules were developed for three main groups

within the schools: (a) teachers; (b) parents; and (c) students (Figure 2). The leaflets were developed to provide detailed guidelines on how to ride the Trans Semarang (Figure 2). The leaflet provided: (a) general information on how to ride the bus safely; (b) specific information about safety aspects inside the bus; (c) payment methods to buy tickets; (d) standard rules and regulations; and (e) regular schedules and maps of routes.
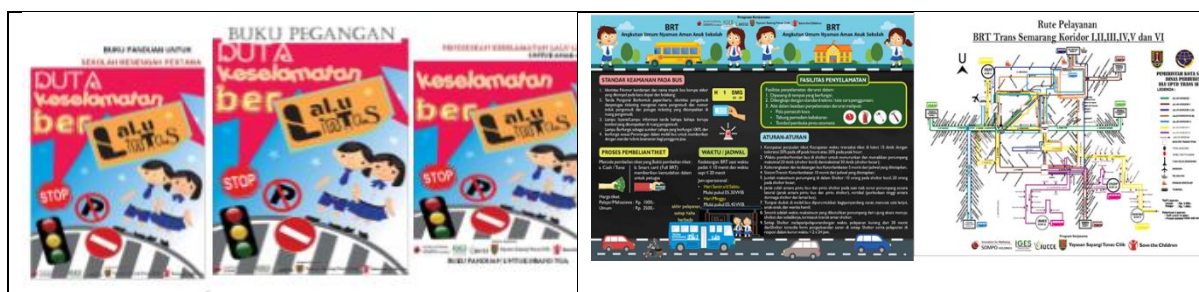

Figure 2. Modules on road safety and leaflet on how to use the bus

2) Capacity building and training for trainers (school teachers, parents and peer educators)

The second step was capacity building for trainers to increase their knowledge and awareness of Trans Semarang, and to carry out traffic safety assessments regarding the vulnerability of schools. The activities included a workshop on developing plans for activities under the program together with teachers and parents as participants; selecting trainers for each school; and identifying school activities to be used to implement the awareness-raising campaign. Participants gathered information such as knowledge about road safety, information on traffic policy and how to use public buses safely for junior high school students, traffic problems and vulnerability in the school vicinity, and the basic needs for implementation of awareness training for students. Training for trainers was performed over two days in November 2017. The activities covered practical training on road safety, recognizing trafficked areas surrounding the schools and riding the buses. Three main points related to the assessment of traffic vulnerability such as pedestrian access, traffic jams and traffic situation in the morning (start) and afternoon (finish), and additional street occupation by street vendors (especially during the afternoon) were also covered. Finally, participants were able to develop maps indicating traffic vulnerability and transport infrastructure in a .5-1 km radius of each school.

3) Implementation of the awareness-raising program;

The third step was the actual implementation of training programs by the facilitators. The training encouraged active participation from the students, self-assessment, hands-on activities and role-playing. The program consisted of three steps: (a) assessing the traffic vulnerability for commuting; (b) providing knowledge, information and skills on traffic safety and (c) encouraging students to pass on the knowledge to classmates. The awareness-raising program was held from mid-November to early-December 2017 or around 2 –3 weeks depending on time availability at each school. There was a student-led activity to assess traffic vulnerability for commuting, knowledge information and skills on traffic safety, and a practical program on how to ride the bus (Figure 3).

Figure 3 Awareness-raising program

4) Monitoring and evaluation of the program:

The final step was the monitoring and evaluation of the impact of training on the intentions and behaviour when using the Trans Semarang. A comparative analysis was conducted by using the data from the baseline and post-training survey. The post-training survey was distributed to two groups of respondents: participants and non-participants of the awareness-training program. By comparing the responses of these two groups, it was possible to analyze the initial impact of the training program on the intention to use Trans Semarang for school travel. The post-training survey was conducted at the end of December 2017 to gather about 125 students from all grades and schools. The sample size was around 14.5% of the participants of the baseline survey (Table 1) and 61.6% of the sample were those who had participated in the awareness-raising program while the remaining set of respondents did not participate (Table 1).

Table 6. Impact on knowledge, intentions and behavior

No	Variables	Participant		Non-participant	
		Freq	%	Freq	%
A	**Impact on the sharing of knowledge and information**				
1	Transfer of knowledge and information to other classmates or friends				
	a. Distribute the information to other colleagues	64	83.1%	n/a	n/a
	b. Don't pass on information to others	12	15.6%	n/a	n/a
	c. Missing Data	1	1.3%	n/a	n/a
2	How to distribute information to others (multiple answer)				
	a. Direct communication	45	29.8%	n/a	n/a
	b. Wall Magazine	45	29.8%	n/a	n/a
	c. As an agent of change (show to other students)	23	15.2%	n/a	n/a
	d. Through extracurricular or class room	38	25.2%	n/a	n/a
B	**Impact on the intentions and behavioral changes**				
3	Intention to use Trans Semarang				
	a. Yes, willing to use Trans Semarang	56	72.7%	n/a	n/a
	b. No, not willing to use BRT	8	10.4%	n/a	n/a
	c. No response	13	16.9%	n/a	n/a
4	Behavioral Change				
	a. Increase the frequency to use Trans Semarang	38	49.35%	n/a	n/a
	b. Don't change the frequency to use Trans Semarang	15	19.48%	n/a	n/a
	c. No response	24	31.17%	n/a	n/a

Source: Author's survey & recapitulation.

The monitoring data demonstrated the impact on the awareness-raising campaign to use Trans Semarang in the short-term. The number of students willing to use Trans Semarang increased to 72.7% while the remaining 10.9% did not want to use the bus for various reasons. The survey confirmed almost 50% of students increased their willingness to use Trans Semarang, while nearly 20% of students did not. An assessment of the reasons indicated that the main reason students were reluctant to use Trans Semarang was because of its coverage areas (odd routes and no shelter near their house). We also found student's ability to make mode choice decisions was another reason. In many cases, parents did not allow students to use Trans Semarang for school travel. This is consistent with claims elsewhere that students may not be able to make decisions about their mobility options (E. Mocca, 2015) and parents may be an important audience for future awareness-raising programmes (Ahsan, 2015). By comparing the response given by participants and non-participants, the results suggest that the awareness-raising program also encouraged students to act as a messenger by transferring the information to their other colleagues (Table 6). Finally, the survey showed about 83.1% of participants passed their knowledge on to classmates through direct communication and wall magazines.

5. DISCUSSION AND CONCLUSIONS

Although the share of public transport is relatively small compared to other modes in Semarang, there has been an increasing trend in student use of Trans Semarang over the last five years. Increasing our understanding of travel behaviour among students, one of the largest groups of Trans Semarang users, is the first step in an inclusive process that can boost transport resilience. With these important aspects

in mind, it is important to take the next steps--that is, discouraging the use of private vehicles for daily school travel, and preventing the modal shift to private vehicles as young adults. To encourage a modal shift from private to public transport, especially for the young generation, raising awareness of students will be critical. A series of awareness-raising training activities were carried out for these purposes in three junior high schools in Semarang. The activities were facilitated by a multi-stakeholder process wherein the education department facilitated communication with teachers, parents, students and other critical stakeholders such as the police department, transportation agency, and bus operators. It was particularly important to engage parents because, as survey results would later show, parents play an important role in the program, as some students lack the autonomy to make decisions about how they get to school.

The research found variation in the number of passengers due to school holiday seasons. The study also confirmed the modal shift of going to and returning from school in Semarang. The drop-off service with private vehicles is popular for going to school; Trans Semarang is used more frequently to return home from school. The affordability, comfort, security and opportunity to socialize are some of the benefits of Trans Semarang. However, the online ride-hailing service is also popular and may overtake buses in the future (Nugroho, 2019).

This article shows that an awareness-raising program can be an effective way to alter attitudes and travel behaviour among young people. It also demonstrates that a social experiment can help shift these attitudes and behaviours. The article further clarified that this can be achieved through a cascade and a peer-to-peer system. The cascade system involved disseminating information through trainers to about 77 students who voluntarily participated in the program. The peer-to-peer system helped the transfer of knowledge from participants to classmates—for instance, about 83% of training participants passed on the knowledge to their classmates through direct discussion/communication and wall posters. A further set of activities involved the provision of trainers for the subsequent training of teachers, school committees and parents. Delivering messages or campaigning to other students by trained students (a peer-based system) is also effective and efficient, especially in light of time and budget restrictions. To make awareness raising sustainable, however, it is imperative to integrate these activities into the curriculum and relevant school activities, such as orientation programs for new students.

The fact that awareness-raising increases the willingness to use Trans Semarang is also important to boosting transport resilience in Semarang. Doing so will encourage a key segment of the ridership to use a mode that is inherently more resistant to climate and related impacts. Awareness-raising has the potential to encourage those from a young age to shape transport patterns in the future. Semarang's government seems to have recognized this potential. For instance, it has introduced programs such as special pricing for students to encourage students to use Trans Semarang. It may also adopt other similarly motivated efforts such as a smart card for non-cash payments. However, as this article makes clear, a critical piece of the resilience puzzle is raising awareness of the benefits of public transport for key ridership segments. Above all, awareness-raising should not only feature cost, comfort, and socialization opportunities, but also public safety.

Another dimension of building resilience is appreciating the shortcomings of the current system. On this point, the survey research revealed that a lack of infrastructure is a key barrier in preventing a modal shift to the public transport system. The lack of access for some students is a considerable constraint. One way of addressing these kinds of barriers is not simply to raise awareness, but to create an interactive consultative process that informs decisions on public transport. Such a process could be used to generate inputs which could then be put towards bottom-up sustainable and resilience urban mobility strategies.

There is still the need for future research to derive effective interventions and improve programs for adolescences. What is the best campaign, over what duration, and for which grade and age group? Which are the most influential encouraging modal shifts? These remain key questions. Such questions require more systematic and evidence-based research on the impacts of awareness programs. This study can only draw conclusions on the short-term effects of behavioural change. Future research

should also investigate whether the effect persists. An additional challenge, but also a potentially fruitful avenue of inquiry, involves expanding the program to other schools in Semarang to create a bigger impact on travel behaviour among junior high school students.

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