Transport Policy 29 (2013) 23–28

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Active school trips: associations with caregiver walking frequency

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ARTICLE INFO

Available online 14 May 2013

Keywords:
Active travel
Bicycling
Walking
School travel
Sidewalks
Built environment

ABSTRACT

Household and parental characteristics and perceptions of walking and the built environment may reduce the propensity of children to use active travel modes (walking and bicycling) for their school trip. This paper examines whether there is a relationship between walking or bicycling to school and the walking habits of caregivers or parents. A statewide pedestrian survey of New Jersey residents was used to assess the mode taken by children for their school trip (age of respondents (parents) 19–84; $n=353$). Socio-demographic characteristics, public school density, full and part-time employment status of respondents, self-reported frequency of walking of adult respondents and perceived neighborhood environment characteristics are used as independent variables. Logit models are estimated to test associations between these variables. Non-minority ethnic status, women respondent's employment type, higher income, and vehicle ownership are negatively associated with active travel to school, while higher public school density is positively associated with choice of an active travel mode. Even in favorable circumstances for active travel to school, the employment circumstances of parents or caregivers may deter children from walking to school. When parents are active, their children are also more likely to be active. Poor sidewalk quality also deters parents from letting children use active modes for their school trip.

1. Introduction

Over the last two decades, there has been growing concern over childhood obesity. As a result, increased attention has been placed on children's physical activity as well as on their ability to travel to school using non-motorized modes (McDonald, 2008a, 2008b, 2008c, McDonald, et al., 2010, McDonald and Aalborg, 2009, Timperio et al., 2006, Schlossberg et al., 2006, Rodriguez, 2009, Boarnet et al., 2005). Deficiencies in the built environment, such as lack of adequate sidewalks and unsafe road crossings have been identified as impediments for increasing non-motorized travel to school (Ewing et al., 2004). Studies have found that construction of sidewalks and street-crossings, and the installation of traffic control devices can increase the proportion of children walking to school in areas where these changes are made (Boarnet et al., 2005). The overall "walkability" of the neighborhood (Kerr et al., 2006) is also a factor associated with children walking or bicycling to school. Another benefit of walking or bicycling to school in safe environments is that children can travel independently. Evidence suggests that the skills children develop from independent journeys can benefit social, emotional and cognitive development (Joshi and MacLean, 1995).

Within this context, policies to encourage additional active modes of travel for children are seen as one component of reducing childhood obesity levels. The literature on travel and urban form has informed work in this area, however, parental perceptions, lifestyles, and employment activities may be equally important elements in the decision on how children travel to school. The research presented here investigates these issues by examining relationships between the parent (or caregivers) walking behavior and the choice of allowing children to use active modes of travel to school. Parental walking behavior is a proxy for household lifestyles (including employment activities) and perceptions of the built environment and can serve as a key mediator in analyzing the choice of letting children use active modes of travel to school.

The perceptions that parents have about their neighborhood can be an important determinant of the mode used by children for their school trip. Since parents (or other caregivers) ultimately decide on the child's mode of travel to school, their perceptions are a critical determinant of a child's travel behavior. These perceptions may be strongly tied to the specific local environment of

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http://dx.doi.org/10.1016/j.tranpol.2013.04.001

their residential location as well as the route traveled to school. In particular, parental perceptions of traffic safety and neighborhood safety are stronger predictors of school travel mode than factors associated with urban form (McDonald, 2008a, Timperio et al., 2006, Kerr et al., 2006, McMillan, 2007, Timperio et al., 2004). Parental perceptions of crime, limited public transport, no lights or street-crossings, number of street-crossings necessary to get to school, no parks or sports field or playgrounds, and driver attitudes to speeding are negatively associated with parents letting their child walk to school (Timperio et al., 2006, Timperio et al., 2004, Dellinger, 2002). The presence of sidewalks and walking and bicycle facilities, as perceived by parents, are also important variables in deciding on the feasibility of allowing a child to walk to school (Kerr et al., 2006). McDonald et al. (2010) additionally argued that the social environment, i.e., "child-centered social control", defined as an expectation that residents in a neighborhood will be protective of the children in the neighborhood may affect the likelihood that parents will allow their children to walk to school.

Parental employment patterns, especially whether the mother has part-time or full-time employment, is associated with how school trips are made. Mothers with part-time employment have been found to drive their children to school more frequently, or be available when the children need to go to school (McDonald, 2008c, Timperio et al., 2006, Black et al., 2001). The commute trip for women is typically shorter (or closer to the home) than that for men (Madden, 1981, Turner, Niemeier, 1997) implying they may have more responsibility (or sole responsibility) within a household for getting children to school.

The main research questions investigated are the following. Is there a relationship between the walking activity of parents and whether children walk or bicycle to school? Is there any difference in this association when other school transportation modes are included (school buses and public transportation)? For example, in New Jersey school buses are made available when the student lives two miles or more from their school, thus we would expect some differences in choices when included in the analysis. How do perceptions of the neighborhood environment affect caregiver choice of how children travel to school?

These research questions imply the following two key hypotheses that are tested in our analysis. First, it is hypothesized that when parents or caregivers are dissatisfied with various neighborhood characteristics, especially those associated with the safety of the neighborhood, there is a reduced likelihood that a child uses an active mode of travel to school. Second, it is hypothesized that when parents or caregivers themselves engage in more walking activity, their children are more likely to walk or bicycle to school.

Parents may choose to live in a neighborhood because their children can then walk to school as well as being more inclined to walk themselves. This creates a problem of self-selection in our data; however, recent research suggests this may not be a major problem (Cao et al., 2009), though we recognize this as a limitation in our analysis. The availability of walking opportunities, because a neighborhood is more walkable, may also determine parental walking habits and in turn influence their decision to allow children to walk or bicycle to school. To explore these hypotheses explicitly, we also control for household socio-economic characteristics and density of public schools in each school district; the latter is a proxy for distance to schools, which was not available in our data. We expect that children from white non-Hispanic and high income households will be less likely to take active school trips and that there will be a positive association between school density and active travel mode choice. According to McDonald (2008b), the behavior of white non-Hispanic and high income households is mainly due to living in lower density areas with distances to school that are not amenable to walking.

2. Methods

2.1. Data

Our analysis used data obtained from a cross-sectional survey of pedestrian activity, behavior and attitudes in New Jersey. The key focus of this survey was to gather data on the walking behavior of New Jersey residents as well as their perceptions of how walkable their local environment is. For those respondents with children additional information on their school trip mode was collected.

As the survey was not designed exclusively to analyze school trips, there are various shortcomings in the information available. This includes no information on the distance to the school or its location. We supplemented the data with public school data from New Jersey to build a variable for public school density to serve as a proxy for distance in our analysis. School trip information was gathered for only one child in each household (oldest and youngest were selected at random); this was done primarily to not overburden respondents, as the school trip information was not the primary purpose of the survey. An additional omission was determining whether the respondent was the parent or caregiver, but all respondents were adults aged 19 or over.[2]

The data was collected via a random-digit-dial telephone survey in November 2009. The statewide sample was supplemented with an oversample of Jersey City, in order to obtain a larger sample from a more walkable area. Overall there were 1200 completed interviews, 400 of which were the Jersey City oversample. From the combined sample, 374 respondents had children who attended school and for whom information on the school trip was collected. After excluding records with missing values, 353 observations are used in the analysis. The survey protocol was approved by the Rutgers University Institutional Review Board.

Respondents' age ranges between 19 and 84. Most are likely parents; others would most likely be caregivers, guardians, or others living in the household (such as older siblings, grandparents, or other relatives). As there is no way of identifying the specific relationship, the term caregiver is used throughout this paper. Considering that about 80% of the respondents' ages are between 30 and 55, however, the observations, by and large, most likely represent parental responses.[3]

2.2. Model specification

Binary logit models were estimated to examine how parental walking habits and perceptions of neighborhood characteristics are associated with the modes children use for school travel. Two different binary dependent variables are estimated in separate logit models. One set of models evaluates the active modes (walking and bicycle versus all others). The second set of models evaluates all instances of not being driven to school versus being driven (i.e., including school buses and public transportation). Table 1 provides a breakdown of the distribution of these categories. Nearly 30% of children in the sample walked or bicycled to school. With inclusion of the school bus and public transportation modes, 57.5% of children in the sample are not driven to school (13 of the children take public transportation).

Independent variables include socio-economic characteristics, public school density, parental walking habits, and parental

[2] The survey did not include information on the residential address of respondents. Instead we asked respondents what the nearest intersection to their home was; this was subsequently geo-coded to provide home location data.

[3] Those respondents with children in the household have a mean age of 42, while those without have a mean age of 58, lending support to the assumption that respondents are caregivers.

Table 1
Distribution of travel modes.

Mode (353 Observations)	Count (%)
Active modes	100 (28.3)
Walk	95 (26.9)
Bicycle	5 (1.4)
Non-car modes	203 (57.5)
Active modes (sum walking and bicycling)	100 (28.3)
Public transportation	13 (3.7)
School bus	90 (25.5)
Driven to school in a car	150 (42.5)

satisfaction with the built environment and neighborhood safety. The socio-economic characteristics used are those of the adult respondent. The only information obtained on the children was their mode of travel to school. Ethnic groups were divided into non-Hispanic white and other. Since non-Hispanic white families are more likely to own a car and have other options, they are more sensitive to the travel behavior of their child (McDonald, et al., 2010). As "choice walkers"(McDonald and Aalborg, 2009), they are more likely to use a car than other ethnic groups.

As mentioned previously, employment status – full-time, part-time or unemployed – can affect the flexibility of a caregivers' schedule. The data available from the survey identifies the employment status of the respondent. We categorize the employment status of the respondent based on their gender and whether they are employed full-time or part-time. These four categories are compared to a reference category that includes unemployed and looking for work, retired, going to school, homemaker, and disabled/unable to work. Our assumption is that those who are not working will have more flexibility to take children to school and more time to accompany them by walking.[4] We also include a dummy variable for annual income greater than $100,000. Public school density (the number of public schools per square mile) is used as a proxy for school distance. The greater the density, the closer a school is expected to be to a respondents' home. The number of vehicles owned by a household is an important factor affecting school children's travel mode and is also included in the models. The measure of parental walking activity was based on a question on walking frequency. This was asked as a categorical variable based on whether the respondent walks more than once a day, once a day, several times a week, or several times a month or a few times a year or less (this latter is the reference category in the regression models).

Survey respondents were asked to rate their satisfaction with nine neighborhood characteristics using a four point Likert scale. Satisfaction with crime prevention and policing, quality of sidewalks, quality of crosswalks, quality of street lighting, quality of traffic signals and signs, traffic law enforcement, availability of parks or playgrounds that can be walked to, overall safety of pedestrians, and overall quality of the neighborhood for walking were used. These were coded as dummy variables based on whether they indicated they were satisfied or not satisfied. Our second set of models tests the additional effect of these variables on the choice of mode for the school trip.

Results are presented as odds ratios. This can be interpreted as the relative likelihood that the variable affects the outcome. An odds ratio greater than one is equivalent to a positive coefficient or effect, while those less than one are equivalent to a negative coefficient or effect.

[4] Data on the number of people employed in a household was not available.

Table 2
Summary statistics.

Variable	Percent for categorical variables, mean (std. dev.) for continuous
White non-hispanic	46.18
Public school density (schools/1 sq mile)	1.41 (s.d.=1.42)
Employment categories	
Female full time employment	26.63
Female part time employment	7.37
Male full time employment	32.58
Male part time employment	2.55
Unemployed, retired, going to school, Homemaker, disabled, and others (reference)	30.03
High Income (> $100,000)	29.18
Number of vehicles owned per household	1.78 (s.d.=1.16)
Respondent Walking Frequency	
More than once a day	37.11
Once a day	19.26
Several times a week	26.91
Several times a month, and a few times a year or less	16.72
Respondent Satisfaction with Neighborhood Characteristics (Very and somewhat satisfied)	
Crime prevention and policing	79.32
Quality of sidewalks	66.57
Quality of crosswalks	77.34
Quality of street lighting	72.80
Quality of traffic signals and signs	89.24
Traffic law enforcement	77.05
Availability of parks or playgrounds to walk	79.60
Overall safety of pedestrians	70.25
Overall quality of neighborhood for walking	80.45

3. Results

Summary statistics for the independent variables used in the regressions are in Table 2. The frequency of walking was measured using the question, "on average, about how often do you walk outdoors for 5 min or more?". Some 83.3% of respondents walked at least several times a week. Less than 17% walked outdoors several times a month or a few times a year. Regarding satisfaction with neighborhood characteristics, at least 65% of respondents say that they are satisfied with each individual characteristic. Almost 90% of respondents are satisfied with traffic signals and signs, but the satisfaction level drops to 66.6% for the quality of sidewalks, the neighborhood characteristic for which there is the least satisfaction. These satisfaction variables represent the perception that respondents have on these neighborhood attributes.

Model estimation results are shown in Tables 3 and 4. The latter includes neighborhood satisfaction variables. Two binary logit models are estimated for each set of variables, one for the active modes (walking and bicycling) vs. non-active modes, and the second for non-car modes (walking, bicycling, bus) vs. being driven to school.

White non-Hispanic households are less likely to engage in active modes of travel. This may be due to most living in more suburban neighborhoods with minimal walking infrastructure, while other ethnic groups live in more walkable urban neighborhoods. There is, however, no statistically significant ethnicity difference in the models for all non-car modes versus being driven. Interestingly, 85% of white non-hispanic respondents are satisfied or very satisfied with the walking environment in their neighborhood. White Hispanic and black populations are less satisfied (about 75% are satisfied or very satisfied).

As public school density increases, school children are more likely to walk to school. This is true because more densely

Table 3
Binomial logit model.

Variables	Active modes: walk/bicycle vs. other modes		Non-car modes (walk/bicycle/bus) vs. being driven	
	Odds ratio	z	Odds ratio	z
White non-Hispanic	0.550	−1.82	0.728	−1.22
Public school density	1.445	2.45	0.875	−1.29
Parental employment types[a]				
Female full time employment	0.563	−1.59	0.596	−1.66
Female part time employment	0.184	−2.39	0.447	−1.68
Male full time employment	0.667	−1.14	0.989	−0.04
Male part time employment	0.843	−0.20	1.141	0.17
High income (> $100,000)	0.519	−1.74	0.680	−1.41
Number of vehicles owned	0.518	−4.01	0.583	−4.32
Respondent walking frequency[b]				
Walk more than once a day	5.327	3.18	1.373	0.91
Walk once a day	5.690	3.07	1.822	1.52
Walk several times a week	3.607	2.29	0.878	−0.36
Log likelihood	−157.71		−213.73	
Number of observations	353		353	
LR chi2(12)	105.38		53.91	
Pseudo R^2	0.2504		0.112	

[a] Reference category includes unemployed, retired, going to school, homemaker, disabled, and others.
[b] Reference category includes several times a month and a few times a year or less.

Table 4
Binomial logit model with neighborhood perception variables.

Variables	Active modes: walk/bicycle vs. other modes		Non-Car Modes (walk/bicycle/bus) vs. being driven	
	Odds ratio	z	Odds ratio	z
White non-Hispanic	0.531	−1.85	0.685	−1.40
Public school density	1.412	2.35	0.866	−1.27
Parental employment[a]				
Female full time employment	0.562	−1.51	0.567	−1.76
Female part time employment	0.167	−2.43	0.411	−1.83
Male full time employment	0.677	−1.07	0.959	−0.13
Male part time employment	0.769	−0.30	1.092	0.11
High income (> $100,000)	0.487	−1.84	0.639	−1.59
Number of vehicles owned/home	0.503	−4.00	0.573	−4.37
Respondent walking frequency[b]				
Walk more than once a day	5.080	3.07	1.376	0.91
Walk once a day	5.674	3.03	1.832	1.51
Walk Several times a week	3.178	2.03	0.876	-0.36
Parental satisfaction with safety				
Crime prevention and policing	0.918	−0.22	0.882	−0.37
Quality of sidewalks	1.897	1.78	0.713	−1.17
Quality of crosswalks	1.052	0.12	0.950	−0.16
Quality of street lighting	1.027	0.07	1.592	1.54
Quality of signals and signs	1.006	0.01	0.984	−0.04
Traffic law enforcement	0.611	-1.33	0.767	−0.84
Parks or playgrounds to walk	2.257	2.07	1.353	0.95
Overall safety of pedestrians	1.327	0.75	1.282	0.80
Overall quality of walking	0.713	−0.75	0.682	−1.01
Log likelihood	−152.35		−210.32	
Number of observations	353		353	
LR chi2(17)	116.11		60.74	
Pseudo R^2	0.2759		0.1262	

[a] Reference category includes unemployed, retired, going to school, homemaker, disabled, and others.
[b] Reference category includes several times a month and a few times a year or less.

populated urban areas will tend to have schools located in closer proximity to residents, if only because they have more public schools. As mentioned previously, this variable serves as a proxy for distance to the school, given that we did not have the actual distances in our data. Earlier results that omitted this variable gave essentially the same results as when it is included.

Those households with a female respondent who is employed part-time are also less likely to have a child use an active or non-car mode for traveling to school. Male respondent employment status generally has no effect. While these variables do not fully capture the pattern of employment in a household, this result suggests that the schedule of women is important and that they are more likely to take on the responsibility of getting children to school. The relationship is especially strong for women working part-time. We can only speculate as to the cause of this relationship. There may be two behavioral responses occurring: those with a full-time job have less flexibility and thus drive their children to school as part of a regimented routine, while those working part-time might have more flexibility which in itself gives them the time to drive their child to school. This result holds across all the binary choices modeled. The role that household work schedules play in school travel decisions is clearly deserving of additional research.

Odds ratios for the income dummy variable are less than one (implying a negative effect), and only statistically significant in the active travel models at the 90% level. This implies that wealthier households are less likely to allow their children to walk to school or that they might select their children's school based on characteristics other than proximity. As the number of vehicles owned by a household increases, school children are also less likely to walk or bicycle and more likely to be driven to school. This effect occurs in all the models estimated.

The more frequently the respondent engages in walking activity, the more likely a child engages in active travel for the school trip. In particular, the strength of this association is strongest for frequent walkers (at least once a day). This finding supports the hypothesis that caregiver walking habits are an important factor in allowing children to travel to school by active modes. In the model that includes bus use among the non-car modes, the frequency of walking among parents or caregivers had no influence on the likelihood of children using non-car modes versus being driven to school. Thus, the inclusion of buses changes the association with parental walking habits, most likely because those having their children use the bus live further from the school. While this is surprising it does add additional support to the hypothesis that parental walking habits affect how parents let their children walk to school, when the option to walk is readily available. One interpretation is that the caregiver who walks more will transmit this behavior to their child. An alternative explanation is that the likelihood of the respondent walking more frequently may be due to unmeasured attributes of neighborhood walkability that also make it more feasible for children to walk to school.

One potential caveat to this result is that respondent walking frequency may be partly due to walking their child to school. However, only 33% of our sample reported this as a reason they walked in the previous 30 days. Table 5 shows results for 15 different reasons given by our survey respondents. The reasons most often reported were for pleasure or relaxation, physical exercise or going for a stroll. While only 16 respondents reported no reasons for walking in the last 30 days, of those who reported walking a child to school, all reported other walking trip purposes. Thus, this suggests that the walking activity of the respondent is not just due to their walking a child to school.

The perceived attributes of the neighborhood are further controlled for in the models shown in Table 4. The results on respondent satisfaction with neighborhood attributes show relatively weak effects, while the walking frequency estimates are of a similar magnitude to the models in Table 3. Walking frequency is not correlated with any of the satisfaction variables (results not

Table 5
Reported walking trip purposes.

Walking trip purpose	Frequency (%)
Walk a child to school	118 (33.4)
Commute to work	97 (27.5)
Commute to school	62 (17.6)
Walk to a bus stop or train station	146 (41.4)
Get some recreation for pleasure or relaxation	218 (61.8)
Do some physical exercise	218 (61.8)
Go for a stroll	232 (65.7)
Walk the dog	85 (24.1)
Walk your child to a park or playground	167 (47.3)
Go grocery shopping	124 (35.1)
Go to a restaurant/bar	107 (30.3)
Go on shopping trips other than grocery shopping	126 (35.7)
Go to a doctor or dental visit	83 (23.5)
Do personal errands other than going to doctors, walking children to school, or visiting friends or relatives	158 (44.8)
Visit a friend or relative	172 (48.7)

shown), so inclusion of these variables suggests that the behavior of the caregiver may be an important determinant of active travel to school, rather than perceptions of various neighborhood attributes. The correlation between the perceived satisfaction, caregiver walking behavior, and the socio-economic variables was examined and there were no strong correlations. Factor analysis was also used to see if there were any patterns in the perceived satisfaction variables, but none were found, thus all the variables are included in the model.

Of those perception variables, satisfaction with the quality of sidewalks is associated with increased use of active travel modes for the school trip, however, this does not hold up for non-car travel to school (i.e., including buses). Satisfaction with the availability of parks or playgrounds that can be walked to is positively associated with active travel for school trips, as well. The association between this variable and travel by active modes is stronger than that of satisfaction with the quality of sidewalks. These two variables indicate that physical infrastructure could be of importance for safe routes to school. An interesting result is that parental satisfaction with traffic law enforcement is negatively associated with the use of active modes although the level of statistical significance is weak, below the 90% level of confidence ($z=1.33$). It was expected that this would be a positive effect, so it is surprising that as satisfaction with traffic enforcement increases, active travel to school decreases. One possible reason is that perhaps those areas with higher levels of traffic enforcement (and consequently higher satisfaction) are also those with less safe traffic conditions. None of the satisfaction variables have any reasonable level of statistical significance in how they affect the choice of non-car modes (i.e., including buses) vs. driving. Research in Australia (Timperio et al., 2006, Timperio et al., 2004, Dellinger, 2002) assessed perceptions that children have about perceptions on their journey to school. They found stronger associations between similar factors and active travel. The analysis here assessed parental satisfaction, not that of children. As parents are the decision-makers, it is a bit surprising that associations were not found with most of these factors.

4. Conclusions

One limitation of this analysis is that the survey was not designed to explicitly analyze school travel. The main omissions were that there was no information on the distance to the school from the home and there was only information on one child from each household. Additional data on whether caregivers walked with their children and more detail on household employment patterns would also be desirable. However, given these constraints, the analysis still provides useful information for understanding how household walking behavior may influence the active travel of children for their school trip.

Despite these limitations a key result of this analysis is the linkage between employment patterns, walking frequency of respondents (most likely parents), and the mode chosen for the school trip. Associations between parental satisfaction with neighborhood characteristics were generally not a major factor in choice of school trip mode. Results also show some differences associated with the choice of an active travel mode (walking and bicycling) versus all potential non-car travel modes (i.e., including buses).

Household socio-economic factors – non-minority ethnic status, female respondent employment type, higher income, and vehicle ownership – are negatively associated with active travel to school (walking or bicycling). Higher public school density is positively associated with choice of walking or bicycling. Increased vehicle ownership is associated with reduced active travel to school and increases the likelihood of children being driven to school. It is likely that those households with more vehicles live in neighborhoods that are less walkable.

The flexibility of caregivers to both assist with active travel and to drive children to school seems to be largely dependent on the female respondent's work status. Those that do not work, may have the flexibility to have their children use active travel modes (perhaps because they have time to accompany them). Another explanation is that for those who are employed, time constraints and convenience make it easier to simply drive children to school by maintaining a regimented schedule. This effect is stronger for those women respondents who are employed part-time. One could argue that this provides them with the flexibility to drive their children to school, and their choice to work part-time may reflect a desire to be engaged with their child's education. These issues clearly deserve more detailed analysis with more directed survey questions.

Those respondents that engage in more walking activity are also more likely to not drive their children to school. This could represent other unmeasured factors associated with the built environment of the neighborhood, including more walkable infrastructure and local activities that can be walked to; however, given that the satisfaction variables do not reduce the magnitude of the walking frequency effect, it is likely that there is some element of parental or household behavior that leads to more active school travel for children. It is also possible, that those households that desire to walk more self-select to live in a more walkable neighborhood, both for themselves and so their children can be more active and independent.

Policy implications derived from this work suggest that finding ways to influence the behavior of parents can be beneficial for increasing active travel to school by children. While providing more opportunities for children to walk to school by providing safer walking environments is clearly beneficial, supportive parental behaviors are a necessary factor, especially among non-minority higher income households. Understanding how constraints on time and parental employment influences the propensity to not drive children to school needs additional research, but policy focused on parental behaviors can be helpful for increasing active travel to school.

Acknowledgments

This research was funded by the New Jersey Department of Transportation, Safe Routes to School Resource Center under NJ Task order 246. The views expressed in this article are those of the