



Vehicular Traffic Congestion and Externalities: Effects on Geography Students' Journey to School and Achievement in Plateau State, North Central Nigeria

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Date of Submission: 02-06-2024

Date of Acceptance: 12-06-2024

ABSTRACT: The study investigated the effect of vehicular traffic congestion on students' journey to school and how this problem interacts with school arrival time, participation in classroom and achievement in Geography among senior secondary school students in Plateau State, North Central Nigeria. Descriptive survey design was used for the study. The target population was 22,190 senior secondary school students of Geography in their second year. The sample was 95 students who journeyed to school through both light and heavy vehicular traffic sampled using purposive and simple random sampling techniques. The instruments used for data collection included a Home-School Distance Checklist (HSDC), Observation Schedule and a Geography Students' Achievement Test (GSAT). Data collected was analysed using percentage, mean score, standard deviation Chi square and t-test for independent groups techniques. The findings from the study showed that most students (87.5 percent) covered a distance of at least two kilometers (2km) to school. School arrival time, classroom participation and academic achievement between students who journeyed to school through light and heavy vehicular traffic differed significantly in favour of students who journeyed through light vehicular traffic. Recommendations included installation of traffic control lights in combination with personnel at locations associated with heavy traffic flows, planned construction and maintenance of heavy traffic roads, teachers' use of appropriate teaching approaches to foster students' participation and students' modified schedule of activities to minimize the impact of traffic congestion on their school arrival time, classroom participation and academic achievement.

Keywords: Achievement, Geography, Journey to school, Vehicular traffic congestion.

I. INTRODUCTION

Geography, a core subject in Nigeria's senior secondary school level, deals with the study of naturally occurring and human phenomena on the earth surface. These include study of processes that result to emergence of the phenomena, their distribution and location, as well as their spatial interactions and interdependences. The contents of the senior secondary school geography curriculum, developed by National Educational Research and Development Council (NERDC, 2012) subsumes, Local Geography, Earth and the Solar System, Environment and its Resources, Regional geography of Nigeria, Map Reading and Interpretation, Economic and Human Geography and Introduction to Geographic Information Systems. Thus, the sub-fields of geography in the curriculum includes Physical, Human and Practical Geography. These are relevant for future training in specialties of teaching, cartography, tourism, geomorphology, meteorology, climatology, biogeography, hydrology, oceanography, surveying, geographic information systems, urban planning, development studies, remote sensing and pedology, just to state a few. These underscores the importance of Geography to human existence, national development and progress. Contrary to the preoccupation of ancient Geography with memorization on names of continents, countries, rivers and mountains, the current Geography is more systematic, quantitative and scientific in approach, and thus, offers more reasonable explanations to human existential realities, activity and processes surrounding the earth over time and space (Khalil et al., 2015).

The immediate beneficiaries of Geography education at any level of learning are the students. It is knowledge that Schools, Colleges and Universities have no worth without students because they constitute one of the most essential



components of any educational institution. Therefore the development of any country in all ramifications is directly linked with students' achievement. Thus, students' achievement plays an important role in any country's development as they are the drivers of social development (Irfan & Shabana, 2012). Measurement of students' achievement has received considerable attention in researches including Irfan and Shabana (2012), Rugutt and Chemosit (2005) and Farooq et al. (2011). While there seems to be concord on some of the factors affecting students' achievement, there also seem to be a variation in some just as the authors themselves. Students' achievement could be attributed to social, psychological, economic, environmental and personal factors, classified by Farooq et al. (2011) as student factors, family factors, school factors and peer factors. These factors strongly influence students' achievement, but also vary from person to person and country to country. Also, while some of these factors have been overbeaten, some have received little or no research attention amongst which is environmental externalities.

Externalities reflect the positive (benefits) and or negative (cost) implication on the operation of a system as a result of activities/operations of another external to it (Dileep et al., 2013). A typical condition that explains externalities is the environmental impact of the usage of fossil fuel in the transport sector, which contributes to the large volumes of greenhouse gases in the earth's atmosphere. This is known as environmental externalities of the transportation fuels. This is so because the fuels were only intended to be used as sources of energy but ended up with an additional effect of polluting the environment. Generally, externalities can either be human (cultural) or environmental. They are cultural when they come directly from human and environmental when they originate from the environment. Environmental externalities are greatly multi-faceted and can be generated from many sources. Sources could include bush burning, deforestation, vehicular traffic congestions and many more depending on the objective. This study shall emphasize on vehicular traffic congestion as a source of environmental externalities as it affects students' journey to school and achievement in geography.

Development of a robust transport network in many countries of the world has proven to be one strong economic vein (Baryalai & Lenka, 2012). However, doing that comes with a lot of environmental problems, one of which is vehicular traffic congestion due to improved standard of

living. Traffic congestion is a growing concern in many metropolitan areas (Martin et al., 2013). For instance, vehicular traffic congestion costs the United Kingdom government 4.3 billion Pounds annually (Milojevic & Rakocevic, 2013) and costs over \$3 billion annually in Lagos, Nigeria (Ima, 2023). Vehicular traffic congestion is the overcrowding of routes (roads) leading to slow and inefficient flow (Araujo et al., 2014). Emissions from road transport vehicles are major contributors to greenhouse gases and are suspected to be linked to respiratory problems and diseases (Baryalai & Lenka, 2012). The emission contains carbon dioxide (CO₂) which is the most potent of all greenhouse gases because of its long residence period in the earth's atmosphere (100 – 200 years), thus a major contributor to global climate change (Robert et al., 2007). Other environmental problems of transportation system are acid rains, smog formation and pollution (Baryalai & Lenka, 2012). More so, Takyi et al., (2013) gathered that the stiffest of vehicular traffic congestions are observed in cities during morning hours when people set out for their daily activities. But Martin et al. (2013) added that traffic congestions also occur in the evening, when people retire from their day's activities. This poses a lot of difficulty on road users including students traveling from home to school through congested roads, while those close to their homes take a walk at ease to school.

Traveling through stiff vehicular traffic congestion, the students' journey to school is brought to a halt until the road becomes free after some time. Some traffic congestions last for hours and when this happens, students would have to wait for long, coupled with inhalation of the emissions from the exhausts of vehicles. This congestion also causes urban heat island (rise in temperature of the congested area arising from human activities particularly in industrialized areas), which is grossly inadequate for one to remain within as it might cause suffocation and irritation. More so, lateness (tardiness) and averting punishment when traffic lasted for too long make students prefer to walk rather than waiting over a long distance away from school. This contributes a lot to their weakness and impaired concentration in learning during the morning hour classes. Students may abscond from school or arrive very late and exhausted, which may to a large extent, affect the students' ability to assimilate and their attention span. In this case, what could be making learning difficult and achievement low, might not be teacher centered or associated with the student but vehicular traffic congestion encountered on his or



her way to school, which might have had negative impact on the students of geography.

Marchesini and Weijermars (2010) in their work on the relationship between road safety and congestion on motorways, reviewed literature on the potential effects of road safety and traffic congestion on motorways and gathered that high traffic volumes capacity resulted in higher crash rates. This stresses that the roads are not safe for people because of increased frequencies of crashes. Students who journey to school daily are exposed to such risks of losing their lives. It has been found that home-school distance affects academic achievement (Adeyemi & Adeyemi, 2014). The issue of home-school distance is one of the ordeals of education in Nigeria that could be bedeviling achievement of students over the years particularly in suburban and rural areas. Students have to travel great distances from their homes to school. The physical, psychological and physiological implications of trekking through long distance could be enormous and affect students' achievement in geography and other school subjects. Dana and Leigh (2010) revealed that a dramatic difference exists between students who attended school close to their homes and those who went to schools afar off their homes. Here, learning and achievement are hampered by environmental externalities associated with vehicular traffic congestion.

The subject of achievement is centroid to every educator because that serves as the basis for measuring the effectiveness and success of educational programmes per time –achievement tells the extent to which the teachers as well as the students have achieved learning objectives. The goal of every education system is to maximize achievement though it is a goal that seems unachievable. Though research efforts have been targeted at improve learning and students' learning outcome in Geography, it is worrisome that as high as 71.9% of candidates who sat for WASSCE in the study area made grades below the credit level ($\leq D7$) in geography between 2015–2022 (Educational Resource Centre, ERC, 2023). In the year 2020, 20.1% passed geography at credit level, which does not differ for other years (2015 – 2022). Over the same period of time, the Chief examiners for West African Examination Council (WAEC) and National Examination Council (NECO) have reported that students' achievement in geography did not meet minimum expectation. Some students travel as far as 10km to attend school (Kristiansena, et al., 2006; Adele, 2008; Marcella & Kagema, 2014) against the stipulated maximum home-school

distance of 1km in Nigeria (Duze, 2010). Such journey-to-school experience could have degrading effect on school arrival time and classroom participation, thus having ripple effect on learning and preparedness of candidates for careers in geography for national and global impacts. Hence these inspired the study.

The study intended to investigate the effect of vehicular traffic congestion on students' journey to school and their achievement by investigating these unplanned and unexpected occurrences outside the classroom before the students arrived at school, which could impact the teaching-learning process and academic achievement in geography. This research efforts sought also to establish how vehicular traffic congestion impacted geography students' school arrival time and participation during lessons every school day. This study therefore assumed an association between vehicular traffic congestion and students' achievement, school arrival time and classroom participation, which constitute the live issues in the study.

Objectives:

The objectives of this study included:

1. To determine the distance students covered on journey to school daily.
2. To determine the effect of vehicular traffic on students' school arrival time.
3. To determine the effect of vehicular traffic on students' classroom participation.
4. To find out the achievement mean scores of students who journeyed through light or heavy vehicular traffic in geography.

Research Questions:

The study shall answer the following research questions:

1. What distances do students cover on journey to school daily?
2. What is effect of vehicular traffic on students' school arrival time?
3. What is the effect of vehicular traffic on students' classroom participation?
4. What is the achievement mean scores of students who journeyed through light or heavy vehicular traffic in geography?

Hypotheses:

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between students who journey through light vehicular traffic



and students who journey through heavy vehicular traffic in school arrival time.

2. There is no significant difference between students who journey through light vehicular traffic and students who journey through heavy vehicular traffic in classroom participation.

3. There is no significant difference between students who journey to school through light vehicular traffic and those who journey through heavy vehicular traffic on geography achievement mean scores.

II. METHODOLOGY

Research Design

The research design employed for the study was descriptive survey. The design fits the nature of the research as it requires the collection of data through survey, observation and description of the situation of the students under study based on the study variables.

Sample and Procedure

The population of interest was the second-year senior secondary school Two students that offered geography in Plateau State, Nigeria. This is constituted of 22,190 students of geography in secondary schools in the study area. The sampling techniques used for the study were purposive and simple random. Purposive sampling was employed to select two local government areas (LGAs) with considerable possibility of vehicular traffic congestion from which the study would hold in which Jos South and Jos North LGAs emerged. Simple random sampling was used to select one school each from Jos South and Jos North LGAs which had 92 and 172 senior secondary schools in that order. The sample comprised of 95 geography students from which 50 and 45 traveled to school through light and heavy vehicular traffic respectively.

Instruments

Data was collected for the study using a home-school distance checklist (HSDC), observation schedule and a geography students' achievement test developed by the researcher and validated by two experts in Geography and one in Educational Measurement and evaluation. The reliability of the instruments were ascertained using data from a pilot study. The home-school distance checklist (HSDC) was composed of 5 items which sought to collect information about distances

students covered in journey to school with reliability coefficient of 0.93 computed using Pearson Product Moment. The Observation Schedule was used to collect data on students' school arrival time and classroom participation during geography lessons with reliability coefficients of 0.96 and 0.94 in that order computed using Pearson Brown Split-Half method. The observation schedule consisted of checklist with 'Timely' and 'Late' options for school arrival time. Options on classroom participation included 'Active' and 'Passive'. The Geography Students' Achievement Test (GSAT) made up of 50 multiple choice questions was used to measure students' achievement with a reliability coefficient of 0.98 calculated using Pearson product Moment method.

Statistical Analysis

Data collected was analysed using percentage, mean score, standard deviation chi square (χ^2) and t-test for independent samples. Percentage, mean score and standard deviation were used to answer the research questions while chi square and t-test were used to test the hypotheses formulated.

Data Collection Procedure

The instruments were administered by trained research assistants, one each from the selected schools in the study area, which were the geography teachers in those schools. The HSDC was administered to the students in their schools for period of six weeks. The research assistants also collected data daily about the students' school arrival time and classroom participation using the observation schedule. This was done for students who journeyed through light and heavy vehicular traffic in the morning when schools opened and during geography lessons over a period of six weeks. At the expiration of the period of instruction (six weeks), the achievement test (GSAT) was administered by the research assistants to the students for onward processing and analyses.

III. RESULTS

Data collected was summarized and analysed to answer research questions and test hypotheses as follows:

Research Question One: This research question sought to find out the distance students cover on journey to school on a daily basis. Results are presented in Table 1.



Table 1: Summary of Distance Covered by Students on Journey to School in Plateau State, Nigeria.

Home-school Distance (Km)	N	Frequency	Percentage (%)
≤ 1	95	12	12.5
2		43	45
3		19	20
4		7	7.5
≥ 5		14	15
Total	95	95	100

Table 1 reveals the home-school distance covered by students on their journey to school in the study area. The results showed that 12 (12.5%), 43 (45%), 19 (20%) and 7 (7.5%) students covered ≤ 1, 2, 3, 4 and ≥ 5 kilometers respectively. This clearly suggests that only 12.5 percent of the students lived within the stipulated 1km or less,

while 87.5% took journeys of at least 2km to school in the study area, thus can conclude that schools are not easily accessible to most students.

Research Question Two: This research question intended to find out the effect of vehicular traffic on students' school arrival time on school days. Summary of results are presented in Table 2.

Table 2: Summary of Students' School Arrival Time based on Nature of Vehicular Traffic.

Vehicular Traffic	N	Timely	Late	Total
Light	50	1140 (76%)	360 (24%)	1500 (100%)
Heavy	45	284 (21%)	1066 (79%)	1350 (100%)

The data in table 2 shows that 50 students who journeyed through light vehicular traffic were 1,140 (76%) times timely to school all together and 360 (24%) times late to school. Also, 45 students who journeyed through heavy vehicular traffic were all together 284 (21%) times timely and 1,066 (79%) times late. This implies that students who traveled through light vehicular traffic were early

to school compared to their counterparts who traveled through traffic congestion.

Research Question Three: This research question intended to find out the effect of vehicular traffic on students' classroom participation during lessons. Summary of results is presented in Table 3.

Table 3: Summary of Students' Classroom Participation based on Nature of Vehicular Traffic.

Vehicular Traffic	N	Active	Passive	Total
Light	50	516 (86%)	84 (14%)	600 (100%)
Heavy	45	65 (12%)	475 (88%)	540 (100%)

The data in table 3 shows that 50 students who journeyed through light vehicular traffic were all together 516 (86%) times active in classroom and 84 (14%) times passive. Also, 45 students who journeyed through heavy vehicular traffic were all together 65 (12%) times active and 475 (88%) times passive. This suggests that students who traveled through light vehicular traffic were more

active and participatory in classroom activities than those who traveled through traffic congested roads.

Research Question Four: This research question sought to ascertain the achievement mean scores of students who journeyed through light or heavy vehicular traffic in geography. Summary of results is presented in Table 4.

Table 4: Summary of Students' Achievement Mean Scores based on Nature of Vehicular Traffic.

Vehicular Traffic	N	Mean (\bar{x})	Standard Deviation (Std.)	Mean Difference
Light	50	62	14.6	25.8
Heavy	45	36.2	14.2	

Table 4 shows that 50 students traveled through light vehicular traffic to school and had an achievement mean score of 62 with a standard deviation of 14.6, while 45 students who journeyed

through heavy vehicular traffic had an achievement mean score of 36.2 and 14.2 standard deviation. The results clearly indicate that students who



journeyed through light vehicular traffic to school achieved better with a mean difference of 25.8.

Hypothesis One: This hypothesis tested for significant difference between students who

journey through light vehicular traffic and students who journey through heavy vehicular traffic in school arrival time. Summary of results of the analysis is presented in Table 5.

Table 5: Chi Square Analysis of Significant Difference between Light and Heavy Vehicular Traffic Roads on Students' School Arrival Time

Vehicular Traffic	N	Timely	Late	df	χ^2	p-value	Decision
Light	50	1140	360	1	858.58	.000	Reject
Heavy	45	284	1066				

The data presented in Table 5 is results of χ^2 test of significant difference between students who journeyed to school through light vehicular traffic and students who journeyed through heavy vehicular traffic in school arrival time in the study area using SPSS (Version 20). The results show that the calculated value (χ^2) is 858.58, the degree of freedom is 1 and p-value is .000. The decision is to reject the hypothesis at .05 level of significance. This is because $p = .000 < .05$, implying that the test for difference is significant. The decision

means there is a statistically significant difference between students who traveled through light and heavy vehicular traffic in school arrival time in favour of those who journeyed through light traffic.

Hypothesis Two: This hypothesis tested for significant difference between students who journey through light vehicular traffic and students who journey through heavy vehicular traffic in classroom participation. Summary of results of the analysis is presented in Table 6.

Table 6: Chi Square Analysis of Significant Difference between Light and Heavy Vehicular Traffic Roads on Students' Classroom Participation

Vehicular Traffic	N	Active	Passive	df	χ^2	p-value	Decision
Light	50	516	84	1	622.14	.000	Reject
Heavy	45	65	475				

The data presented in Table 6 is results of χ^2 test of significant difference between students who journeyed to school through light vehicular traffic and students who journeyed through heavy vehicular traffic in classroom participation in the study area using SPSS (Version 20). The results revealed that the calculated value $\chi^2 (1) = 622.14$ while and $p = .000$ at .05 level of significance. Since $p = .000 < .05$, the decision is to reject the hypothesis indicating the test for difference is

significant. The decision connotes that there is a statistically significant difference between students who traveled through light and heavy vehicular traffic in classroom participation in favour of those who journeyed through light traffic.

Hypothesis Three: This hypothesis tested for significant difference between students who journey to school through light and heavy vehicular traffic on geography achievement mean scores. Results of the analysis are summarized in Table 7.

Table 7: t-Test for Independent Groups Analysis of Significant Difference between Light and Heavy Vehicular Traffic Roads on Students' Academic Achievement

Vehicular Traffic	N	Mean (\bar{x})	Mean Difference	df	T	p-value	Decision
Light	50	62.0	25.8	93	8.718	.000	Reject
Heavy	45	36.2					

Table 5 shows the results of t-test of significant difference between students who journey to school through light and heavy vehicular traffic on geography achievement mean scores using SPSS. The results show that $t(93) = 8.718$ and $p\text{-value} = .000$. Since $p = .000 < .05$, there was sufficient evidence to reject the null hypothesis,

thus was rejected with a conclusion that there was a significant difference between students who journeyed through light and heavy vehicular traffic on achievement mean scores in favour of the former.

IV. DISCUSSION



This study set out to investigate home-schools distance covered by students to school every school day. Focus was also placed on what effects the nature of students' journey to school could have on their daily arrival time and participation in classroom activities, particularly vehicular traffic. Further, the study investigated the resultant effect of vehicular traffic on students' academic achievement in geography in Plateau State, Nigeria.

Findings revealed that most students (87.5 percent) traveled a distance of at least 2km to school as against the 1km ideal stipulated distance for journey to school. Furthermore, some students resided over 5km away from school and had to travel that distance on school days while very few students (12.5 percent) lived within the one kilometer stipulated home-school distance in the study area. This finding aligns with Adele (2008), Duze (2010), Marcella and Kageema (2014) and Tetali (2017) who found in separate studies that students lived beyond the stipulated one kilometer. Tetali (2017) specifically found that the average distance to school was 2.1 kilometers and as much as 64.5 percent of students lived from 1 kilometer and greater, which supports this finding. This is instructive because the distance between the student's home and school is considered by Nakpodia and Dafiaghor (2011) as a possible cause for tardiness.

Vehicular traffic congestion was found to be significantly effective in determining students' school arrival time. Students who traveled to school through roads with light vehicular traffic were timely in their arrival to school as opposed to their counterparts who journeyed through heavily congested roads by vehicular traffic. The finding suggests that all things being equal, the more students encountered vehicular traffic congestion on their journey to school, the later they would arrive at school and resume for lessons in the area where the study was carried out. This finding is in consonance with Mabebe and Emmanuel (2013) who revealed that journey to school led to students' late arrival and tiredness. Similarly, Tetali (2017) submitted that traffic congestion increased the likelihood of tardiness experienced by students, especially students who walked to school. This affirms that the timeliness of students' arrival at school is strongly associated with the nature of vehicular traffic encountered on the way to school. Whereas timely arrival is associated with light vehicular traffic, lateness or untimely arrival is associated with students who journey through vehicular traffic congested roads.

The study also gathered that vehicular traffic is potent enough to influence students' classroom participation. The results offered that in the study area, students who journeyed to school through light vehicular traffic participated more during classroom discussions, while students that journeyed through roads congested with vehicular traffic engaged lesser or not at all. This finding supplied sufficient evidence to refute the hypothesis of no significant difference in classroom participation of students based on the nature of vehicular traffic encountered on daily journey to school. This finding found harmony with Takyi et al. (2013) who reported that traffic congestion disrupts involvement in business and classroom activities culminating in reduced productivity. To buttress this finding, Cadaoas et al. (2019), in a Philippine study reported that students stuck in traffic congestion get stressed, bored, angry and anxious, hence reported minimal or even no participation during classroom discussions.

The study collected that those students who journeyed to school through light vehicular traffic achieved significantly higher than those who journeyed through heavy vehicular traffic congested roads on the geography students' achievement test. Students who journeyed to school through light traffic roads demonstrated better understanding as reflected in their achievement mean score, while on the other hand, students who journeyed to school via heavy vehicular traffic congested roads reported significantly lower scores on the achievement test. The researchers are left without doubts about this finding as the result is in concord with Cadaoas et al. (2019), who found that traffic congestion affects students' academic achievement, and further argued that when students come to school late and miss their class discussion, it will have a big impact on their academic achievement. This emphasizes that that heavy traffic does not only make students tardy, but most of them got low grades as well. In this light, vehicular traffic congestion is not just a problem in Plateau State, North Central Nigeria, but widespread globally.

V. CONCLUSION

The findings of the study guaranteed the researchers to conclude that most (Up to 87 out of every 100) students in Plateau State of Nigeria journeyed for at least two kilometers to school on a daily basis. Another conclusion is that students who traveled via light vehicular traffic arrived at school timeously and participated more in classroom discussions during geography lessons than students



who traveled to school through heavy vehicular traffic. Finally, finding supported the conclusion that students who journeyed to school through light vehicular traffic achieved significantly better than those who journeyed through heavy vehicular traffic in their academics.

VI. RECOMMENDATION

The following recommendations were made based on the research findings:

1. Traffic lights for controlling flow should be installed where necessary and strict adherence to traffic rules should be enforced in order to reduce risks associated with vehicular traffic flow.
2. The government and private owner should open up schools and ensure children have access to remote schools as this could reduce the distance through which some students traveled to access schools. Deploying personnel to strategic areas of traffic congestion during morning and evening hours which is proven as the time of prevalent vehicular traffic congestion in cities.
3. Infrastructural development such as roads construction should be done in phases especially when areas affected are urban centers. That is, as roads are being constructed or maintained, alternative routes should be provided to allow for free traffic flow.
4. Teachers should employ teaching approaches that encourage the active participation of all students as opposed to teacher-centred approaches that encourage passiveness. By this, stressed, bored, angry or anxious students who journeyed through heavy vehicular traffic might be stimulated to activity.
5. Students should improve their time management skills and prepare for the next school day at night before going to bed. Sleeping early will help students wake early as well.

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