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Understanding of Traffic Signs by Drivers on Urban Roads – A Case Study of Ilorin, Kwara State

Sikirat Damilola Mustapha [a*] and B. A. Ibitoye [aφ]

[a] *Department of Civil and Environmental Engineering, Kwara State University, Malete, Nigeria.*

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The effectiveness of traffic signs, which are used often to promote safe driving and are designed to convey critical information quickly, is contingent on drivers' ability to understand them. Therefore, researchers in Ilorin set out to determine how well-understood and compliant traffic control devices were among drivers representing a range of demographics. The study was conducted using a descriptive survey research approach. The population for this study covers commercial and private drivers in Ilorin. The three local government areas in Ilorin were selected Ilorin South, East and West. A multi-stage sampling technique was used to select three hundred and eighty-four (384) drivers from the population for the study. The research instrument used for the study is a well-structured questionnaire. Statistics including frequency counts and percentages were used to examine the demographic information, the total proportion of drivers who properly recognized the traffic control device, and the variables that contribute to drivers' inability to comprehend traffic control devices. The average comprehension percentage of warning signs, regulatory signs, information sign, driver's knowledge of road marking 56.1%, 60.3%, 64.6% and 59% respectively. The study's findings revealed that 60% of drivers in Ilorin generally comprehended traffic control devices.

[φ] *Supervisor and Professor;*
**Corresponding author: Email: mustapha.loladami@gmail.com;*

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1. INTRODUCTION

With the advent of new technologies and the expansion of the global economy, there are now more cars on the road than ever before [1]. With more people on the road and more time spent in traffic, road traffic has become an increasingly vital part of our everyday lives. However, with more people on the road comes a greater danger of traffic accidents. Each year, road accidents claim the lives of more than 1.25 million people throughout the world. Approximately 1,049 young adults under the age of 25 die in automobile accidents every day. (World Health Organization, 2004); [2].

Despite their widespread usage, the effectiveness of traffic signs relies on drivers' ability to understand them. They were designed to convey vital information quickly to promote safe driving [1]. However, traffic signs are most successful when they attract drivers' attention, deliver the intended message without ambiguity, earn drivers' respect, and provide sufficient lead time for safe action. (Canfield,1999). The information on traffic signs is communicated by a combination of visuals and text. The purpose of traffic signs is rendered moot, however, if motorists are unable to decipher the safety instructions printed on them [2].

The first studies to examine how well drivers understood local traffic signs were conducted in 1966, and the findings generally suggested that drivers' overall comprehension ability was below par. [1] and [3] reported 69% and 40% comprehension respectively. It further said that many drivers lack of understanding of traffic signs is a worldwide issue. There's a connection here to the features of the traffic control equipment.

There is a widespread communication gap between drivers and traffic control equipment. To a large extent, a driver's ability to interpret traffic control devices is determined by his or her own individual traits; in particular, the driver's level of education plays a significant role in this regard. [4,5].

1.1 Problem Statement

The increased danger of traffic accidents is a direct result of the fact that many people spend a significant portion of their days stuck in traffic. The world health organization (WHO, 2004) estimated road traffic fatalities in Nigeria as 39,802. Road signs, markings, and signals in the city of Ilorin, among other things, are there to assist drivers and pedestrians and make sure they're safe, and traffic control signals are shown by traffic cops to keep things moving smoothly. The goal is simple: cut down on car accidents. Despite this, accidents still occur, and they even seem to be on the rise. Therefore, there is need to investigate the level of understanding of the traffic signs. It's important to keep in mind that drivers won't be able to benefit from traffic control devices to the fullest if they don't understand the information embedded in them.

1.2 Aim and Objectives of the Study

The purpose of this research is to determine how well drivers in Ilorin's diverse population comprehend traffic control devices.

The specific objectives are to:

I. Isolate the factors that contributed most to drivers' disobedience of traffic signs and signals;
II. Determine the percentage understanding of the warning, regulatory, informatory and road signs;
III. Tally up the proportion of drivers who generally comprehend the traffic signal;

1.3 Description of Study Area

Ilorin is a city that connects the northern and southern parts of Nigeria. It is located in the transitional zone between Nigeria's traditional forest and savannah areas. There are three different local government areas in Ilorin, and they are respectively named Ilorin West, Ilorin East, and Ilorin South. Ilorin West's LGAs are headquartered in the city, hence it doubles as the state capital. The coordinates for Ilorin are 8°24′N and 83°6′N, 4°10′E and 4°36′E. Its location is important because it links Nigeria's more populous south-western region with its less populous central belt. Ilorin is on the edge of the dry savannah that dominates northern Nigeria and the deciduous woodlands that dominate the south [6].

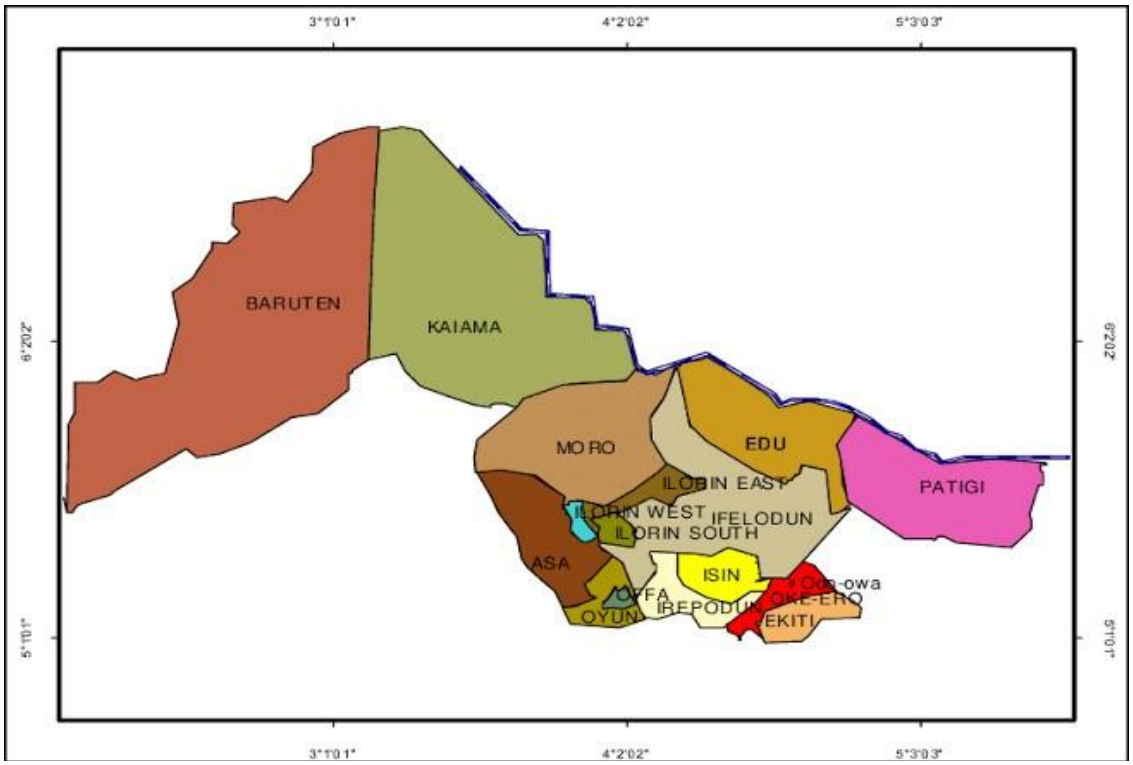


Fig. 1. Map of Kwara state showing the location of Ilorin West, Ilorin East, and Ilorin South (sample areas) [7]

2. LITERATURE REVIEW

2.1 Traffic Control Devices

A traffic control device, often called a road communication tool, is any of a variety of devices constructed, positioned, or drawn by traffic engineers along a road or its shoulder to convey information to drivers. As an added bonus, they are used in traffic systems to educate, control and direct drivers [8,9]. Parking controls, traffic lights, road marking, and signage are all examples of such devices. To add, most methods of conveying information rely on both verbal and nonverbal cues [8]. Therefore, their usage should not be disregarded because of the significant role they play in minimizing road-related conflict and collision as well as road-related accidents. However, motorists and pedestrians alike must take responsibility for learning and adhering to these devices [10]. The installation or placement of any communication tools is subject to a number of conditions, including but not limited to: meeting a specific need; attracting the attention of users; being straightforward and easy to understand; and allowing for sufficient time to formulate an appropriate response [11]. A number of features must be in place for the traffic communication tools to complete the job at hand. Consistency is important because these features aid road users in recognizing them, and they include color (often red, green, yellow, black, blue, and brown), shape (circle, triangle, rectangle, and diamond), legend (symbols), and pattern [12,11,9]. But this is predicated on the fact that these processes take into account human limitations, namely visual impairments. It is reasonable to conclude that the most majority of existing traffic signs meet these criteria; however, it is unclear whether or not this is the case on Nigerian roads [9].

When using signs, be sure there is a direct benefit to doing so. When signs are used inappropriately or not at all, they upset drivers and eventually make them less effective even when they are required. In the same vein, you shouldn't put up signs that enforce a limitation that will be widely disliked and hard to carry out. When motorists see others disobeying signs and getting away with it, they cease taking such signs seriously themselves [13].

The homogeneity of shape, color, and wording across all types of signage helps people see

them from a distance. Standardization only works if the indicators are utilized consistently, so that everyone may reap the benefits [13].

The message should be conveyed in the simplest terms possible. The new signage rely heavily on graphic symbols since those who cannot read may still make sense of them. In rare cases, signs containing written text are utilized. Signs need to be eye-catching enough for motorists to stop and read them. This was taken into mind while designing the signage, but other factors such as sign size and placement should also be considered. Most signs have a range of allowable sizes; the speed of vehicles passing by will mostly dictate which is best [13]. It is essential that sign legends and symbols be easily understood. Since fast-moving motorists need to be able to read a sign from a great distance, this consideration has informed the design of the symbols, font, letter spacing, colors, etc. Because of this, the symbols and text must be sufficiently big for drivers to read from the necessary distance.

Kirmizioglu and Tuydes-Yaman [1] evaluated the readability of 30 common traffic signs. Data from 1,478 urban drivers in Turkey shows that many are unfamiliar with the meanings of traffic signs. Only 12 indicators were recognized by at least 70% of the subjects. In another study in Israel [14], Approximately 30 traffic signs were shown to a sample of 48 undergraduates. We compared the effectiveness of traffic signals using symbolic and textual representations to gauge how well each kind of information is understood. Adding language to symbolic signs improves comprehension and response speed, particularly for less recognized signals.

Advice on how to best direct out-of-country visitors through Orlando International Airport in Florida, including details on sign layout and wording was examined as reported by Choocharukula and Sriroongvikrai [15]. In all, 486 visitors from the United Kingdom, continental Europe, and Latin America were broken down and studied. The reactions of various types of foreign visitors were found to vary. Some people knew what was meant by "International Drive" abbreviated, while others did not.

Shinar et al. [14] found that people in Canada, Finland, Israel, and Poland had similar levels of understanding of traffic signs. The findings of a survey of 1,000 people across five demographic categories—new drivers, tourists, senior citizens, bad drivers, and college freshmen—showed that there was a substantial gulf in understanding between particular sign messages, nationalities of drivers, and levels of education [16-18]. Similar research was conducted by Al- Madani and Al-Janahi [19], who used 28 different signals and tested them on people from Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates. Based on the results, it seems that just 56 percent of the signs were really readable. Evidence suggests a correlation between drivers' education levels, sex, wealth, and country of origin when it comes to their ability to interpret traffic signals.

3. METHODOLOGY

This study used questionnaires to collect information from taxi and bus drivers in the Ilorin metropolitan area. Three hundred and eighty-four (384) questionnaires were administered randomly amongst private and commercial drivers. The sample areas in each of the local government were for Ilorin South – Ministry of Health, Flora School, Unilorin bus Terminal. For Ilorin East – University of Ilorin Teaching Hospital, Maraba Motor Park, Kwara State Polytechnic. For Ilorin West – Sawmill Garage, College of Education Ilorin, Oja Oba park. Fig. 1 shows the map of Kwara State, arrows pointing to the 3 local government areas.

3.1 Sample Approaching and Survey Administration

In-person interview technique was the chosen option to reach the potential respondents. A structured paper-based questionnaire was designed as the survey instrument.

3.2 Survey Questionnaire Design

The questionnaire consists of three main parts; The first section consisted of multiple-choice and short-answer questions regarding the respondents' personal details, including their age, gender, level of education, years behind the wheel, and kind of vehicle. The second part was made so that we could see how well the drivers understood the various traffic signs and signals. Twenty-nine (29) multiple-choice questions about various traffic signs are included here. These signs include eight (8) safety signs, ten (10) regulation signs, six (6) information signs, and five (5) road markings. While the third section was used to examine possible factors that could affect the non-understanding of the traffic control device. Employees of government

agencies, shoppers in shopping malls, company owners and consumers in the area, and commercial drivers in the area are all potential participants in this research.

4. RESULTS AND DISCUSSION

4.1 Demographic Characteristics of Respondents

The demographic characteristics (Gender, Age, Educational Level, Category of Driver and Driving Experience) of the respondents examined is as presented in Table 1.

The results show that 63.1% and 36.9% of the respondents are male and female, respectively. These results corroborate the prior findings of Makinde and Opeyemi [2], Adedeji et al. [9] and Umar and Bashir [5], who found that the majority of research participants were male.

Of those who participated in the survey, 22.2% had completed elementary school, 40.8% had completed middle school, and 37.4% had completed high school or college. That most of the people who filled out the survey had at least a high school diploma is encouraging. That fits with what Makinde and Oluwasegunfunmi [4] found in their research.

According to the data, 10.4 percent of respondents fell into the 18-24 year old bracket, 9.9 percent were 25-30, 41.3 percent were 31-40, 30.6 percent were 41-50, and 7.8 percent were older than 51. This suggests that most of the responders were between the ages of 31 and 40. This result is in agreement with findings of Makinde and Opeyemi [2] and Umar and Bashir [5] and common age range in Nigeria as reported by National Bureau of Statistics [20].

Two hundred and forty-three (243) respondents representing 63.1% were commercial drivers while 142 respondents representing 36.9 % were private drivers. This means that the vast majority of people who filled out the survey drove commercial vehicles.

While 47.8% of respondents had at least 10 years of driving experience, only 11.9% of the total (46) had less than 5 years of driving experience. The results of this research corroborate those of Gana and Emmanuel [21] and Makinde and Oluwasegunfunmi [4], who found that the vast majority of respondents had driving experience of more than ten years.

4.2 Drivers Comprehension of Traffic Signs

Drivers were given a questionnaire testing their familiarity with several types of traffic control signs, including those meant to warn them, those meant to regulate their behavior, those meant to provide them with information, and those meant to provide direction. The responses are presented below while the results are presented in the following sections.

Table 1. Profile of respondents examined

Characteristics		Number	Percentage (%)
Gender	Male	243	63.1
	Female	142	36.9
Age	18-24	40	10.4
	25-30	38	9.9
	31-40	159	41.3
	41-50	118	30.6
	More than 51	30	7.8
Educational level	Primary school	84	21.8
	Secondary school	157	40.8
	Tertiary	144	37.4
Category of driver	Commercial	243	63.1
	Private	142	36.9
Driving experience	Less than 5years	46	11.9
	Between 5 to10years	155	40.3
	More than 10years	184	47.8

4.3 Understanding of Warning Signs

The outcome of drivers' understanding of caution signals is shown in Fig. 2. In this investigation, eight potential warning indicators were considered. Crossroads, Dead End, and a Perilous Double Curve Two-Way Flow, Low Overhead Bridge, Four-Way Intersection, Road Hump/Uneven Pavement, Crosswalk. Respectively comprehended by 90%, 71.8%, 34.5%, 37.3%, 33.8%, 82.9%, 48.5%, and 50%.

Drivers had the best comprehension of the "Roundabout" (90%) and "T-Junction" (71.8%) signs, while "Four-way junction" (82.9%) signs were generally comprehended. The signage' pictures may have helped explain themselves to such a large proportion of people. The "hazardous" double curve sign was comprehended by just 34.5% of drivers, the "thin bridge" sign by only 33.8%, and the "two-way traffic" sign by only 37.3%. A meager 56.1% of people were able to correctly interpret these indicators on average, indicating that their level of understanding was low at best.

4.4 Understanding of Regulatory Signs

Fig. 3 displays the results of an evaluation of 10 different types of regulation signs (no right turn, no parking, no left turn, no U turn, no overtaking, no horn, no pedestrian crossing, speed limit, no halting, no waiting) and the percentages of drivers who understood each kind. It was encouraging to see that 60.3% of respondents got the average question right. While 83.1% of people could decipher the sign reading "speed limit," 79.6% of people could decipher the sign reading "no parking," 75.4% of people could decipher the sign reading "no right turn," 66.9% of people could decipher the sign reading "no left turn," and 71.1% When it came to percentages, 35.6 percent was the hardest to decipher. The necessary signage' self-explanatory visuals likely contribute to the high rate of right responses.

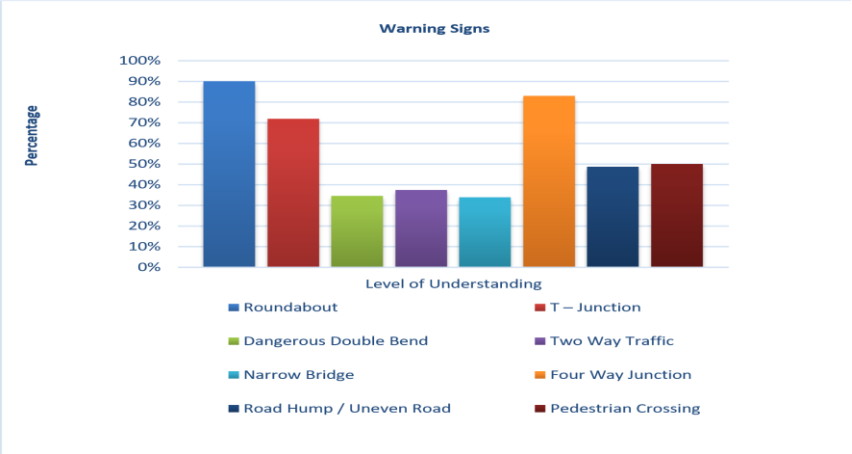


Fig. 2 Understanding of warning signs

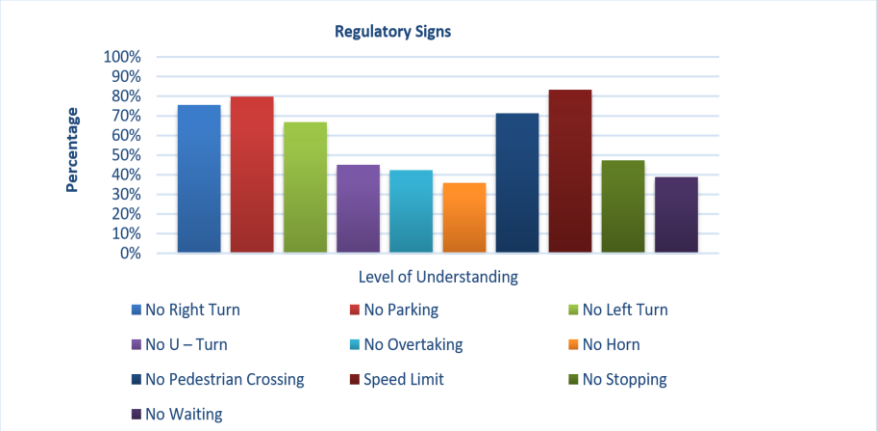


Fig. 3. Understanding of regulatory signs

4.5 Understanding of Information Signs

In Fig. 4, we see the results of an assessment of six different types of informational signs (parking, hospital, bus station, train station, filling station, airport) and the percentages of people who understood each kind. Overall, 64.6% of those surveyed reported having a strong grasp of these indicators. Airport (91.5%), Hospital (73.2%), and Filling Station (67.5%) were the most often known signs.

4.6 Understanding of Road Markings

The outcome of drivers' understanding of road markings is shown in Fig. 5. Results showed that drivers understood 43%, 56.3%, 65.5%, 81.7%, and 48.6% of the five different types of road markings tested (no crossing, warning line, zebra crossing, centre line, do not enter designated area). The middle line and the caution line had the highest levels of recognition, with 81.7% and 65.5%, respectively. It's possible that such large numbers result from the widespread presence and great visibility of such road markers, which contribute to their frequent use and widespread visibility. The phrases with the lowest levels of comprehension were "no crossing," "enter designated area," and "zebra crossing," in that order.

4.7 Overall Drivers Understanding of Traffic Signs

The average comprehension percentage of Warning Signs was 56.1%, average comprehension percentage of Regulatory Signs 60.3%, average comprehension percentage of Informatory Signs 64.6 % and average drivers' comprehension of Road Markings was 59% as presented in Fig. 6. It was observed that 60% of drivers in Ilorin were able to properly interpret the traffic signs and signals they encountered.

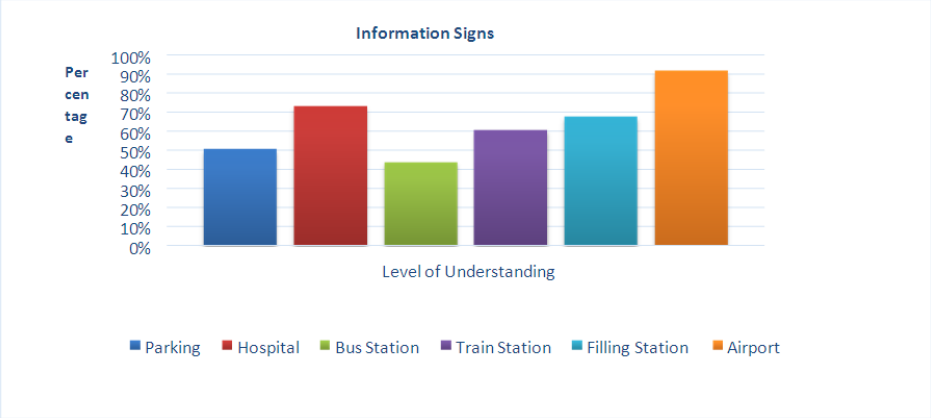


Fig. 4. Understanding of information signs

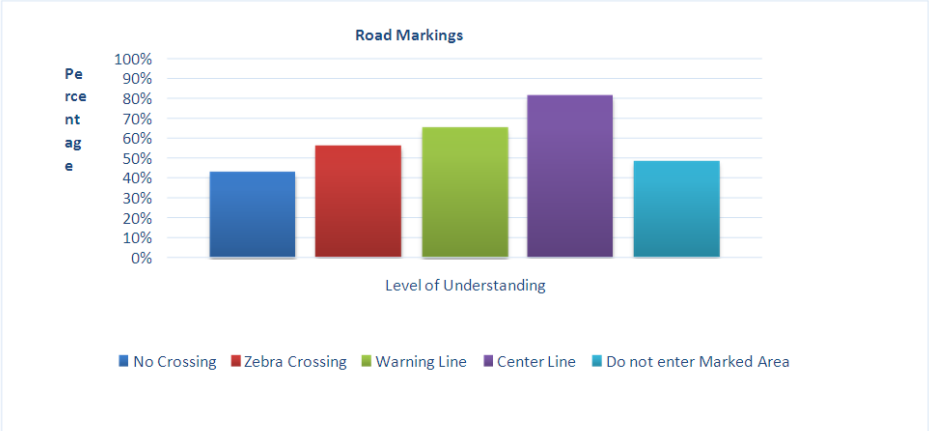


Fig. 5. Understanding of road markings

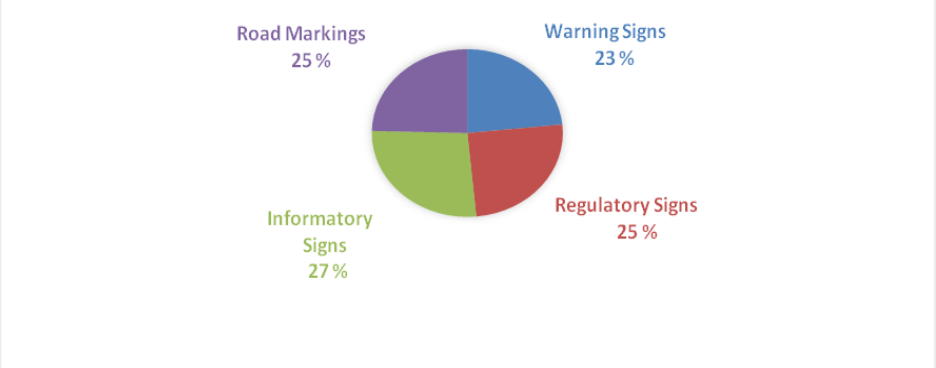


Fig. 6. Drivers over all understanding of traffic signs

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The results of this research provide insight into how well drivers in Ilorin understand traffic signals.
The following inferences were drawn from the study's results:

i. The majority of the respondents who participated in the study were male, majority are educated having gone through secondary school education and more of the respondent are of commercial vehicle type
ii. Information signs were well understood by drivers than other traffic control devices examined with the average understanding level of 64.6%.
iii. Sixty percent of Ilorin's drivers (respondents) were found to have an accurate grasp of the city's traffic signals and signs. The findings also revealed that visible roads signs make it easier for the driver to see and obey the command and direction of the road sign.
iv. These findings corroborate previous investigations showing that motorists often have difficulty deciphering traffic signs.

Research findings informed the following suggestions:

i. Drivers (both commercial and private) in the Ilorin metropolitan area should be required to read a manual on traffic control devices to ensure that they have a thorough grasp of the subject. Other potential enhancements include increasing the frequency with which enforcement occurs and increasing the severity of penalties for violations.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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