Journal of Infrastructure, Policy and Development 2024, 8(15), 9960.
https://doi.org/10.24294/jipd9960

Article

Effects of road users' education programmes on driving behaviour in Nigeria

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CITATION

Adenigbo AJ. (2024). Effects of road users' education programmes on driving behaviour in Nigeria. Journal of Infrastructure, Policy and Development. 8(15): 9960. https://doi.org/10.24294/jipd9960

ARTICLE INFO

Received: 29 October 2024
Accepted: 15 November 2024
Available online: 16 December 2024

Abstract: The menace of road traffic accidents (RTAs) has become a major constraint to development in most developing countries because of driving behaviour. This study examines the effects of road users' education programmes on driving behaviour toward RTA reduction in Nigeria. Data for the study were collected by random sampling of 287 respondents. The respondents comprising road safety officers and drivers were selected at six (6) zonal headquarters of the Federal Road Safety Commission. The questionnaire presented seventeen (17) statements in a 5-point Likert scale for the respondents to rank in order of importance as they have influenced driving behaviour. The data collected were analysed using exploratory factor analysis to identify the most significant effects of road user education on driving behaviour. The study found that road user education programmes have influenced driving behaviour by improving bad driving acts, maintaining good vehicle conditions, and obeying road communication signs. The finding implies that appropriate driving behaviour will reduce road traffic accidents.

Keywords: road user education; driving behaviour; accident factors; vehicle condition; communication signs

1. Introduction

Road Traffic Accidents (RTAs) have become a global epidemic that has been claiming an alarming number of lives and posing a significant threat to sustainable development (Iqbal et al., 2020). This critical issue, previously neglected within the Millennium Development Goals (Perel et al., 2007), was rightfully included as a Sustainable Development Goal (Henry and Shah, 2021; United Nations, 2021; WHO, 2023a). Over the years, governmental and non-governmental organisations worldwide have proposed numerous strategies to combat and reduce the trend of RTAs. However, strategies, such as road expansion, restrictions of certain vehicles, construction of bridges and other road infrastructure, etc., lauded for their success in high-income countries (HICs) often prove ineffective when transplanted to low- and middle-income countries (Boateng, 2020, 2021; Fisa et al., 2022; Haghani et al., 2022; Staton et al., 2016) probably due to poor driving behaviour. This stark dichotomy highlights the need for a place-based analysis, a tailored and localised approach considering a country's driving behavioural tendencies.

Several studies have yielded various RTA reduction strategies, some demonstrably successful in specific contexts, while others remain debatable. This bespeaks the importance of research and continuous adaptation to identify and implement the most effective interventions for RTA reduction (Odusola et al., 2023; WHO, 2023b, 2023c). Most African countries have maintained the status of the

highest number of deaths due to RTAs due to the driving behaviour that makes RTA reduction strategies ineffective (Aga et al., 2021).

Driving behaviour refers to drivers' responses to situations while they are on steering (Sohail et al., 2023). The response is subject to the road environment and the movement of vehicles (Du, et al., 2023). Studies have shown that driving behaviour contributes to major RTAs in most countries (Klauer et al., 2006; Sohail, et al., 2023). Sohail et al., (2023) stated the two categories of driving behaviour as inattentive and reckless driving. The consequence of the two categories of driving behaviour results in the ineffectiveness of road user education. Thus, road user education needs to be focused on influencing driving behaviour to reduce the menace of RTAs.

The literature on driving behaviour in Nigeria is vast but focuses on different aspects other than road user education. For example, Obafemi and Obafemi (2021) looked at the public perception of drivers and examined the factors affecting driver's attitudes. The study of Otto and Edema (2024) focussed on driving behaviour among undergraduates. Other aspects include culture and driving behaviour (Labbo et al., 2024), risk factors (Oluwadiya, et al., 2000), and unsafe driving behaviour (Nzondu et al., 2019). Most of the studies used the popular driver behaviour questionnaire (DBQ) to collect data. This study differs by extracting relevant driving behaviour items from the list of traffic offences of the Federal Road Safety Corps (FRSC) in Nigeria. The goal is to relate the influence of the road user education of the FRSC on driving behaviour. The study determines the significant areas where FRSC road user education has been influencing drivers' behaviour as it serves as a major strategy for improving road safety (Ogwude, 2013).

Therefore, the major question that this study answers is about the major effects of the Federal Road Safety Corps (FRSC) road user education programme on RTA reduction in Nigeria. The Federal Road Safety Corps (FRSC) is the major authorised body tasked with the vision of reducing RTAs in Nigeria (Abiodun and Jembola, 2023). The study aims to examine road user education's effects on driving behaviour in Nigeria. The study contributes to the existing knowledge by applying exploratory factor analysis to identify the significant effects of road user education on driving behaviour in Nigeria. The paper argues that driving behaviour is critical to the rate of road traffic accidents despite strategies that focus on improving road infrastructure, traffic management and control, and effective regulations. So, this study considers the effect of road user education as one of the strategies for improving road safety on driving behaviour.

The paper is structured such that after this introductory section, Section 2 presents the literature review, Section 3 describes the methodology adopted to conduct the study, and Section 4 presents the results and discussion of the analysis. The paper was concluded in Section 5 with conclusion and policy recommendations.

2. Literature review

The literature reviewed for the study focussed on road traffic accidents and driving behaviour. Existing studies on RTA and driving behaviour have indicated an increasing trend in RTA and the contribution of driving behaviour to RTAs.

2.1. Driving behaviour and road traffic accident

The relationship between driving behaviour and road traffic accidents (RTAs) has been a subject of considerable academic discourse in the literature. Luke (2023) stated that RTAs are strongly associated with drivers' behaviour. Across various contexts, researchers have examined how demographic, psychosocial, and environmental factors influence driving behaviour and indicated that addressing RTAs requires a multifactorial approach.

Rahman et al. (2022) investigated the connection between driver behaviour and traffic accidents in Saudi Arabia using a Bayesian Belief Network (BBN), an artificial intelligence model that handles uncertainties and found that driving behaviour, especially speeding significantly enhances accident risks often mediated by weather conditions and road infrastructures. McCarty and Kim (2024) explored the link between risky driving behaviours and RTAs, focusing on the influence of age and gender within the United Kingdom. Their findings supported the notion that human behaviour overwhelmingly dominates RTAs, with specific behaviours such as speeding, driving under the influence of alcohol or fatigue, and distracted driving standing out as common causes of RTAs. The study of Mekonnen et al. (2019) analysed the risky driving behaviour among professional drivers in Ethiopia, showing that beyond individual factors, demographic and socioeconomic factors also contribute to driving behaviour. Many drivers in their study, especially those with performance-based pay, engaged in behaviours such as speeding and running red lights to increase their income, which in turn increased their accident risk. The authors argued that focusing solely on correcting driving behaviour may be ineffective if the broader systemic factors driving such behaviours are not addressed. Similarly, Mahmood et al. (2024) used machine learning to examine how specific driving behaviours, such as lapses, slips, and violations, contribute to RTAs. Alkaabi (2023) and Han et al. (2021) also found that risky behaviours like speeding and fatigue significantly contribute to accidents. In a broader context, Jazayeri et al. (2021) focused on the dangers of distracted driving, showing that this behaviour significantly increases the likelihood of crashes, especially when combined with other risky driving habits.

Studies have also established the role of working conditions in influencing driving behaviours. Amoadu et al. (2023) found that job strain, long hours, and performance-based pay contribute to risky driving behaviours and RTAs. The resulting hazardous behaviours, such as speeding and neglecting safety rules, increase the risk of RTAs, exacerbated by a lack of social support and job security. In Nigeria, Taiwo et al. (2024) studied commercial taxi drivers and highlighted fatigue, driving errors, and inattention as key contributors to RTAs.

2.2. Strategies for reducing RTAs

Two extensive systematic streams of reviews regarding effective RTA reduction strategies yielded a diverse array of findings. While Fisa et al. (2022) considered strategies deemed effective in HICs, they found that behavioural-based interventions significantly contribute to reducing RTAs. Strategies such as random breath testing, selective breath testing, and sobriety checkpoints which are alcohol-deterring methods

were the major strategies that proved effective. They also found that road safety education and enlightenment programmes led to a 9% reduction in RTAs.

Staton et al. (2016) on the other hand, investigated RTA reduction measures and found that an overwhelming emphasis is placed on adequate legislation, speed control, education and enlightenment programmes, enforcement, and road improvement. Perel et al. (2007) emphasised the importance of developing strategic priorities and investing in local research capacity to address the challenges of RTAs.

Interestingly, Rahman et al. (2022) emphasised the need for increased enforcement of traffic laws as a strategy to reduce RTAs. Enforcement of traffic laws was also highlighted by Lefio et al. (2018) who evaluated the impact of various interventions on reducing motor vehicle collisions and their consequences. The same clamour for the localised application of RTA reduction strategies can be seen in the study of Calvo-Poyo et al. (2020), which explored the relationship between infrastructure conditioning factors including the available economic resources in terms of investment and maintenance, and RTA rates in 23 European countries, and found that investment in road maintenance and conservation negatively impacted RTA rates.

Similarly, Chand et al. (2024) recommended a multifaceted approach to RTA reduction with improved road infrastructure, stricter legislation and increased public awareness. Khyara et al. (2022) recommended a combination of infrastructural, institutional, legislative and educational strategies to reduce RTAs. A study by Jisha and Satyakumar (2023) concluded that the importance of infrastructural improvements in road traffic can significantly reduce RTAs and recommended effective public awareness and educational campaigns.

2.3. The research gap

The literature has shown the efforts of researchers towards RTAs with the implementation of relevant policy strategies. The concern for the studies arose from the increasing trend in RTAs in different countries. Also, the literature has established that driving behaviour significantly contributes to increasing RTAs. Several studies have shown that driving behaviour contributes significantly to RTAs among drivers of different ages, genders and professions. However, there is a dearth of research about the contribution of road user education to the reduction of RTAs in literature. The focus of the previous studies provides a gap in the effects of road user education on RTA reduction in Nigeria. This study fills the research gap by examining the effects of the road user education programme of the FRSC in Nigeria. The study contributes to knowledge by identifying the significant effects of FRSC road user education on driving behaviour towards improving traffic safety and reducing RTAs.

3. Data and method

This study employed a survey research design utilising a structured questionnaire to collect data for quantitative analysis. The philosophy adopted for the study is positivism, which allows data collection with appropriate measurement and quantification. The study population comprised commercial drivers, corporate drivers, private drivers, and staff of the FRSC. The exact population for the study was assumed to be infinite because of the lack of access to data that captures the actual number of

the various categories of the population. Therefore, the sample size for the study was determined using Cochran's (1977) formulae. Applying the formulae generates a sample size of 384 respondents for sampling. The formula uses two parameters, the statistical value of *Z*-Score at 1.96 and the error margin at 0.05, to determine the sample size. The formula is provided as;

$$n_0 = \frac{z^0 \cdot P \cdot (1 - P)}{e^2}$$

e: desired level of precision, the margin of error

p: the fraction of the population (as a percentage) that displays the attribute

z: the *z*-value, extracted from a *z*-table

n_0: Sample size

The study areas for the research include the zonal headquarters cities of the Federal Road Safety Corps (FRSC) located in Kaduna State (Kaduna), Plateau State (Jos), Edo State (Benin City), Federal Capital Territory (Abuja), Osun State (Osogbo), and Enugu State (Enugu). The study areas were selected because they are cities with higher operationalisation of FRSC road user education and represent Nigeria's geopolitical zones. **Figure 1** shows the study areas selected for data collection for the research.

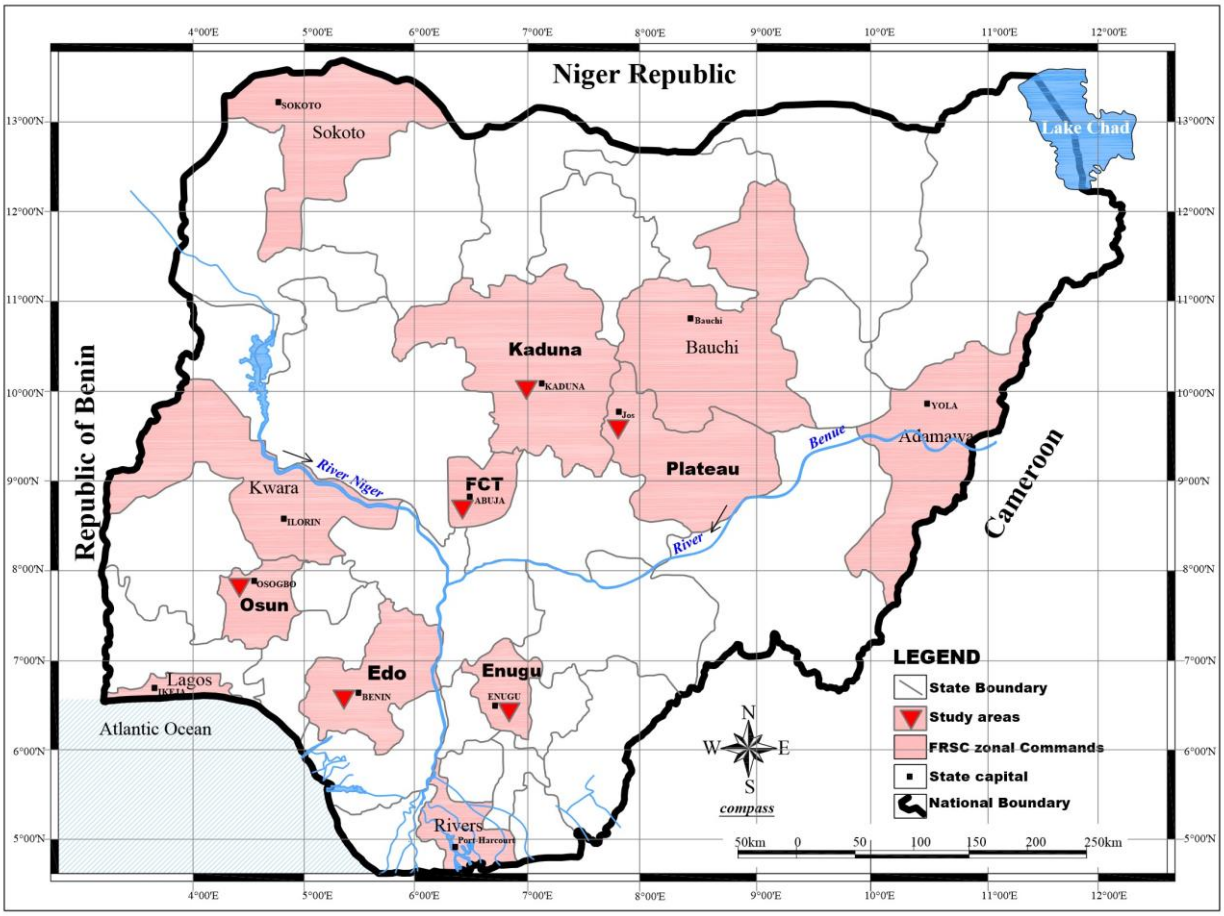

Figure 1. Map of Nigeria showing the study areas.

Source: Adapted from Google Earth Map.

The data for the study were collected by administering a well-designed questionnaire to examine the effects of road user education on driving behaviour in Nigeria. The questionnaire presented close-ended questions for quantitative measurement and analysis. Part A of the questionnaire focused on demographic information. Part B of the questionnaire focused on the effects of road user education on driving behaviour. Part B of the questionnaire presented eighteen (18) statements on a 5-point Likert scale to be ranked in order of significance from 1—Not Significant to 5—Highly Significant. The statements in the questionnaire were generated and adapted from Sabbour and Ibrahim (2010) and the listed traffic offences of the FRSC against wrong driving. 384 copies of the questionnaire were produced and administered using a simple random technique to the respondents. The technique offers the respondents equal chance to be sampled for the study. After the survey, 287 respondents completed the questionnaire with valid responses for analysis. So, the survey recorded a 74.7% success rate.

The data collected were coded and uploaded to SPSS software for analysis. The data were analysed using exploratory factor analysis. The exploratory factor analysis functions to reduce the items to the few most significant ones that serve as effects of road user education on driving behaviour.

The exploratory factor analysis identified road user education's three most significant effects on driving behaviour. Factor analysis aims to determine the number of common factors required to describe the correlations between the observed variables. It also estimates how each factor is related to each observed variable by determining the factor loading.

The mathematical expression of the exploratory factor analysis can take the form below.

$$Y = \lambda k + \varepsilon \tag{1}$$

Where,

$$Y = \begin{bmatrix} y_1 \\ . \\ . \\ . \\ yn \end{bmatrix}, \lambda = \begin{bmatrix} yx \ldots \lambda_{1k} \\ . \\ . \\ . \\ \lambda n_1 \ldots \lambda nm \end{bmatrix}, k = \begin{bmatrix} k_1 \\ . \\ . \\ . \\ kn \end{bmatrix}, \text{and } u = \begin{bmatrix} \varepsilon_1 \\ . \\ . \\ . \\ \varepsilon n \end{bmatrix} \tag{2}$$

A major output of the EFA is called communalities. Communalities estimate the variables by comparing their initial factor loadings with their extracted factor loadings. It indicates the values of variance of each item that represents the final loading factor on the extracted factors. This study values greater than 0.400 at extraction, and any item with a lesser value is said to be small and indicates the items do not fit well with the factor solution and should be dropped from the analysis. Communalities are computed by calculating the sum of the squared loadings for each variable. The formula for determining the communalities is given as;

$$CI = \sum_{j-i}^{n} K_{ij}^2 \tag{3}$$

where *K* is the factor loadings of the variables.

4. Results and discussions

The study applied EFA to conduct a dimension reduction analysis to examine the effect of road users' education programmes on driving behaviour in Nigeria. The test of data adequacy and suitability produced a KMO of 0.919 and a chi-square of 2501.817 at $p = 0.000$, respectively. The result in **Table 1** indicates that the data is adequate and suitable for exploratory factor analysis.

Table 1. KMO and Bartlett's test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**0.919**
Bartlett's Test of Sphericity	Approx. Chi-Square	2501.817
	Df	136
	Sig.	0.000

The communalities outputs of the analysis revealed that one of the items (overloading) had a very low variation of 0.20 (See **Table 2**). It implies that the item does not reflect the effect of road user education on driving behaviour. The result indicates that vehicle overloading does not significantly contribute to drivers' behaviour while driving. It also suggests that the variable is unimportant in discussing road user education's effect on driving behaviour. The item was eventually excluded from the final output of the analysis. Therefore, the final output of the exploratory factor analysis was performed with seventeen (17) items.

Table 2. Communalities of the effects of road user education on driving behaviour.

	Initial	**Extraction**
Overspeed driving	0.624	0.579
Driving without using Seatbelts	0.340	0.456
Driving without extra tyre	0.608	0.492
Reckless Driving	0.731	0.711
Making U-turns at unauthorised points	0.615	0.580
Overloading vehicles	0.318	0.200
Drinking alcohol and driving	0.738	0.701
Lane change signalling	0.526	0.554
Provision of vehicle furniture	0.649	0.554
Maintaining perfect vehicle condition	0.552	0.667
Keeping fire extinguishers in vehicles	0.523	0.430
Parking vehicles at unauthorised places	0.792	0.761
Wrongful overtaking	0.788	0.741
Understanding Road Signs	0.439	0.424
Using phones while driving	0.751	0.681
Controlling steering with one hand	0.630	0.516
Driving in the wrong direction on one way	0.668	0.580
Driving while fatigued	0.785	0.711

Table 3 is the total variance explained for each item of the analysis, and consists of the initial eigenvalues, the percentage of the variance contributed by each item, and the cumulative percentage of the items. In **Table 3**, the total variance explained three (3) factors with an eigenvalue greater than 1, accounting for approximately 67% of the cumulative percentage. The result indicates that the eighteen (18) items in the analysis will be reduced or summarised into three (3) to highlight the effects of road user education on driving behaviour in Nigeria (See **Table 3**).

Table 3. Total variance explained of the road user education effects on driving behaviour.

Factor	Initial Eigenvalues		
	Total	**% of Variance**	**Cumulative %**
1	8.692	48.287	48.287
2	2.403	13.349	61.636
3	1.942	5.234	66.870
4	0.928	5.154	72.024
5	0.711	3.951	75.975
6	0.661	3.671	79.646
7	0.542	3.010	82.655
8	0.520	2.887	85.543
9	0.434	2.410	87.953
10	0.390	2.166	90.119
11	0.337	1.872	91.991
12	0.280	1.554	93.545
13	0.264	1.468	95.013
14	0.243	1.349	96.362
15	0.212	1.178	97.540
16	0.176	0.979	98.519
17	0.151	0.838	99.357
18	0.116	0.643	100.000

Extraction method: Principal axis factoring.

The final output of the analysis is presented in **Table 4** as the rotated factor matrix of the effects of road user education on driving behaviour. The result showed three significant effects of road user education on driving behaviour in Nigeria. Factor 1 has seven (7) items relating to drivers' actions while driving including wrongful overtaking, reckless driving, alcohol drinking and driving, phone usage during driving, driving while the body is fatigued, over speeding and controlling steering with one hand.

Factor 2 has five (5) items relating to the condition of vehicles as a major reflection of driver behaviour. The items include ensuring the perfect condition of every part of a vehicle, equipping the vehicle with adequate furniture for waste and beautification, having sufficient fire extinguishers available in vehicles, ensuring the appropriate usage of seatbelts by drivers and passengers, and keeping quality extra tyre in vehicles. Factor 3 includes five (5) items about communication and driving

behaviour including parking facilities, signs for U-turns, identification of designated one-way roads, directions for lane changes, and adequacy of road signs.

A final effort of the analysis is to name the grouped items as the significant factors. For this study, Factor is named bad driving behaviour, Factor 2 is vehicle condition, and factor 3 is road signs communication. These three (3) factors form the significant effects of road user education on driving behaviour in Nigeria. The finding implies that effective road user education influences drivers' behaviour and driving attitudes, improves vehicle conditions, and helps drivers understand and adhere to road communication signs.

Table 4. Rotated factor matrix of the effects of road user education on driving behaviour.

		F1	**F2**	**F3**
1	Wrongful Overtaking	0.845		
2	Reckless Driving	0.842		
3	Drinking alcohol and driving	0.836		
4	Using phones while driving	0.822		
5	Driving while fatigued	0.822		
6	Over speed driving	0.752		
7	Controlling steering with one hand	0.680		
8	Maintaining perfect vehicle condition		0.814	
9	Provision of vehicle furniture		0.742	
10	Keeping fire extinguishers in vehicles		0.655	
11	Driving without using Seatbelts		0.581	
12	Driving without extra tyre		0.563	
13	Parking vehicles at unauthorised places			0.869
14	Making U-turns at unauthorised points			0.755
15	Driving in the wrong direction on one way			0.738
16	Lane change signalling			0.740
17	Understanding Road Signs			0.650
Factor Name		Bad Driving Behaviour	Vehicle condition	Road signs Communication

According to Factor 1 – bad driving behaviours refer to a driver's attitude during driving. The study implies that road user education influences drivers' attitudes while moving and controlling their vehicles. The factor is associated with risky driving behaviour, accounting for 79.4% of accident causes among professional drivers in Bahidar, Ethiopia (Mekonnen et al., 2019). The finding supports the study of Sabbour and Ibrahim (2010) which finds factors such as using mobile phones during driving, fast driving, driving while stressed and fatigued, alcohol intake, etc., significant in causing accidents among young medical students in Egypt. This study implies that FRSC road user education can reduce RTA by cautioning negative driving behaviour while promoting positive driving behaviour.

The identified Factor 2 is named vehicle condition with items such as perfect vehicle condition, provision of vehicle furniture, carriage of fire extinguisher, using

seatbelts, and driving with extra tyres. The finding implies that vehicle condition in terms of its outward appearance and state of the engine reflects driving behaviour. A vehicle in poor condition tends to result in more RTA than one in good condition. The finding corroborates Sabbour and Ibrahim (2010) who identified bad vehicle conditions as a significant cause of RTA among medical students. Also, Gorzelańczyk (2023) found that the technical condition of vehicles affects traffic safety, which supports the implication of this study that driver's behaviour of operating vehicles with poor conditions contributes to RTAs. It indicates that FRSC road user education affects drivers' behaviour about keeping the good condition of their vehicles.

Road signs communication is the third factor serving as road user education's effect in reducing RTAs. The factor has driver's behaviour items such as parking of vehicles at designated places, making a U-turn at approved junctions, driving one way against traffic direction, behaviour to signal for lane changing while driving, and adherence to road signs. The primary purpose of communication is to provide understanding between speaker and listener. This study shows that road user education provides adequate understanding and adherence to road communication signs by drivers. The finding supports the statement of Masatu, et al., (2022) that road signs play an important role in promoting road safety by reducing RTAs. This is mainly possible if all road users understand road communication signs and their importance to road safety. Following this, Akpan et al., (2015) recommended increased enlightenment campaigns on the meaning, importance and obedience to road signs among motorists. Also, Asadu and Ayuwo (2018) found that many commercial drivers in South-south Nigeria understand road communication signs but willingly disobey the instructions, thereby causing RTAs. This study indicates that road user education needs to be improved to change drivers' behaviour towards adherence to road communication signs to reduce RTAs.

5. Conclusion and policy recommendations

The effect of FRSC road user education on driving behaviour towards RTA reduction in Nigeria was examined using Exploratory factor analysis (EFA). The purpose of EFA is to identify the major effects of FRSC road user education programmes on driver behaviour towards RTA reduction in Nigeria. The study collected data using simple random techniques to survey respondents at cities that host zonal headquarters of FRSC offices in Nigeria. The study identified correcting bad driving behaviour, improving vehicle condition and adherence to road communication signs as the major effects of road user education programmes of the FRSC in Nigeria. The result has implications for road traffic accident rates. It indicates that improved road user education programmes enhance positive driving behaviour and reduce road traffic accidents.

This study has shown that positive driving behaviour can reduce RTAs drastically. However, positive driving behaviour can be achieved with intensive and extensive road user education that focuses on improving good driving behaviour, good vehicle condition and adherence to road communication signs. The study therefore recommends that the government through FRSC improves efforts at conducting effective road user education programmes among different categories of drivers. Non-

governmental organisations and other corporate companies should be encouraged to conduct road user education programmes that focus on improving positive driving behaviour nationwide. The road user education programme should focus on sensitising drivers to good driving behaviour, maintaining good vehicle conditions, and obeying road communication signs. This study streamlines the target of road user education to positive driving behaviour among drivers to reduce road traffic accidents. The implication of the finding applies to both developing and developed countries because RTAs resulting from driving behaviour are experienced across nations worldwide. Practically, this study recommends the need to conduct road user education programmes for different categories of drivers by age group, level of education, and in different urban and rural areas. This would ensure that relevant classes of drivers are enlightened about road safety concerns through education programme that influences driving behaviour.

The study is limited to the experience in Nigeria and survey data collected from drivers on driving behaviour and road user education. The study is also limited to a cross-sectional design that only collects data at a single point in time, limiting insights into the long-term effects of educational programmes on driving behaviour. Future studies should attempt to examine the relationship between driving behaviour, gender, age categories and road user education. This study limited its survey to the six (6) cities with FRSC zonal headquarters. Future studies can survey drivers and FRSC officials across the 36 state capitals in Nigeria to capture a broader scope of the effects of road user education on driving behaviour.

Conflict of interest: The author declares no conflict of interest.

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