

Assessing the Effectiveness of Traffic Education Programs on Driving Practices in Ghana

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ABSTRACT

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Traffic education is crucial in enhancing driver skills, improving road safety, and reducing traffic-related accidents. This study investigates the impact of traffic education on driver behavior, focusing on differences between private and commercial drivers and the influence of driving experience across key content areas, including Traffic Laws and Regulations, Basic Driving Skills, Hazard Awareness, and Road Courtesy. The study employed descriptive and inferential statistical analyses to assess participation rates and the effectiveness of traffic education programs. The results show that Basic Driving Skills emerged as the most frequently engaged and effective content area, while Road Courtesy and Impaired Driving training received little attention. Significant disparities were observed in participation, with private drivers engaging more consistently in structured educational programs than their commercial counterparts. The analysis also indicates that drivers with fewer years of experience report higher impacts from traffic education, underscoring the importance of early and continuous engagement in training programs. Notably, the study found no significant difference in the effects of traffic education based on years of driving experience, highlighting the need for a comprehensive revision of traffic education programs to address these gaps and improve road safety outcomes.

Keywords

Commercial Drivers
Driving Experience
Road Safety
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**Introduction**

Road traffic accidents (RTAs) remain a significant global public health challenge, contributing to over 1.19 million deaths annually and substantial economic losses [1]. These incidents burden healthcare systems, including direct medical costs, long-term rehabilitation needs, and indirect costs such as lost productivity and decreased quality of life [2]. The economic implications extend further, with road traffic crashes costing approximately 3% of the GDP in many countries [3]. These staggering effects demand the urgent need for comprehensive and effective road safety measures to mitigate the impact of these accidents.

Traffic safety education is pivotal in addressing the high incidence of road traffic accidents. Research has demonstrated that well-implemented traffic education programs can positively influence driver behavior, enhance knowledge of traffic laws, and reduce accident rates [4], [5]. The effectiveness of such programs often hinges on their ability to address human factors contributing to accidents, including knowledge of traffic rules, driving skills, and hazard awareness [6].

In Ghana, traffic education is delivered through various channels, including formal classroom instruction, practical training, and public awareness campaigns [7]. The Driver and Vehicle Licensing Authority (DVLA) oversees the accreditation of driving schools and the implementation of driver education programs under ACT 569 [8]. This education encompasses several key content areas for preparing drivers to navigate the road safely.

One of the fundamental components of traffic education is the understanding and adherence to Traffic Laws and Regulations. The Road Traffic Act 683 and the Ghana Highway Code provide the legal framework for road safety in Ghana, outlining essential rules and regulations drivers must follow. Basic Driving Skills, including knowledge of vehicle controls, traffic signals, and road markings, are also emphasized. Drivers are trained in essential skills such as maneuvering, parking, and driving under adverse conditions, which are crucial for safe driving [6], [9]. Hazard Awareness is another critical area where drivers are taught to identify and respond to potential dangers on the road. This includes recognizing environmental factors and anticipating potential threats that could lead to accidents [10], [11]. Closely related to this is Risk Management, which focuses on equipping drivers with the ability to manage

unexpected situations such as brake failure or tire bursts. Proper training in these areas can prevent accidents and significantly enhance driver safety [12]–[14]. Impaired Driving Prevention addresses the risks associated with driving under the influence of alcohol or drugs. Educational programs in this area focus on raising awareness about the effects of substances on driving abilities and promoting strategies to prevent impaired driving [15]. In addition, using Road Safety Equipment, such as fire extinguishers and warning triangles, is emphasized as a vital aspect of preventing accidents and mitigating their severity [16]–[18]. Training in Emergency Procedures, including first aid and using hazard lights, is essential for managing accidents and minimizing injuries. This component of traffic education ensures that drivers are prepared to handle emergencies effectively [19], [20]. Lastly, Road Courtesy is highlighted as a key aspect of traffic education. Encouraging respectful and courteous behavior on the road helps create a safer driving environment, while understanding the influence of emotions on driving behavior is also essential for promoting road safety [21].

These programs aim to enhance driving skills, promote safe driving practices, and ensure adherence to traffic laws. Despite these efforts, concerns remain about the effectiveness and coverage of traffic education in Ghana. This study then examines the impact of traffic education on driver behavior, specifically focusing on the differences between private and commercial drivers and the role of driving experience. By analyzing participation in various content areas of traffic education and evaluating its effectiveness across different demographics, this research aims to provide insights that can inform the design of more targeted, context-specific educational strategies.

Materials and Methods

This research employed a quantitative approach, utilizing a survey design to collect data from drivers to examine the impact of traffic education on driver behavior. The study involved administering structured questionnaires to private and commercial drivers within the Ga North Municipality of Ghana. This design was chosen to allow for the systematic collection of data on driver experiences and perceptions regarding various aspects of traffic education.

The Ga North Municipality is one of the districts in the Greater Accra Region, Ghana. This area was selected due to its high traffic density and the availability of a diverse range of drivers, including commercial and private drivers. The municipality includes major transport hubs and routes, making it an ideal location to assess the effectiveness of traffic education programs on driver behavior.

The study targeted private and commercial drivers with varying years of driving experience. The sample included 60 private drivers and 58 commercial drivers. Using a random sampling technique, participants were selected to ensure representation across

different driving backgrounds. Drivers were randomly approached at various transport hubs and through online survey links to participate in the study. The sample size was determined using Cochran's formula for sample size estimation for unknown populations. A 95% confidence level and a 9.02% margin of error were used.

The questionnaire was divided into three sections: demographic information, evaluation of traffic education content areas, and overall feedback on the impact of these programs on driver behavior. The questionnaire was distributed electronically and in paper format to accommodate different preferences among participants. The study ensured the confidentiality and anonymity of all participants. Informed consent was obtained before participation, and the data were used solely for research.

Data analysis involved a combination of descriptive and inferential statistical techniques. Descriptive statistics were used to summarize the data, including mean and standard deviation for each traffic education content area. Inferential analyses, including Analysis of Variance, were conducted to determine the statistical significance of the impact of traffic education across different groups of drivers.

Results and Discussion

This section presents the data analysis results, focusing on drivers' participation in various content areas of traffic education and the impact of these programs on driver behavior. The content areas were classified under the following broad headings: Traffic Laws and Regulations (TLR), Basic Driving Skills (BS), Hazard Awareness (HA), Risk Management (RM), Impaired Driving Prevention (IDP), Road Safety Equipment (RSE), Emergency Procedures (EP), and Road Courtesy (RC).

A. Driver Participation

Analyzing driver participation in traffic education reveals distinct patterns between private and commercial drivers. From the results, all 118 drivers sampled for the study had participated in at least some of the eight traffic education content areas. However, private drivers exhibited a higher mean participation (45.75) than commercial drivers (39.38), indicating that private drivers are more likely to engage in traffic education programs. This disparity can be attributed to the structure and accessibility of educational resources. Zhao et al. [22] highlighted that private drivers often have better access to formal training and resources, including online courses and private driving schools, than commercial drivers, who may rely more on informal or on-the-job learning. Nonetheless, the overall participation among all sampled drivers was 85.13, suggesting that private and commercial drivers frequently participate in some form of traffic education.

Table 1. Private vs commercial drivers' participation statistics

	Private Drivers	Commercial Drivers
Mean	45.75	39.38
Standard Error	4.79	5.26
Median	46.5	42.00
Standard Deviation	13.54	14.90
Skewness	-1.91	-1.54

The standard error for private drivers was slightly lower than that of commercial drivers (Table 1), suggesting that the mean participation of private drivers is estimated with higher precision. This may reflect a more consistent engagement with traffic education among private drivers, who might have more access to structured education programs. In contrast, commercial drivers, who spend more time on the road and face varying work conditions, may have less opportunity or motivation to engage consistently in such programs. This suggests that private drivers benefit more consistently from traffic education programs than their commercial counterparts. Policy interventions should consider tailored educational strategies that address the specific challenges faced by commercial drivers, such as integrating flexible training modules that accommodate their work schedules. This is supported by Nyamuame et al. [23], who argued that commercial drivers benefit from structured, context-specific training, which is often lacking in existing programs. Moreover, effective traffic education programs should focus on skill acquisition and address the broader behavioral and psychological aspects of driving, which are critical for commercial drivers who face unique road challenges [16]. Targeted outreach and mandatory refresher courses for commercial drivers could help bridge the gap in participation and enhance overall road safety.

B. Content Areas Across the Ages of Drivers

The participation of drivers in various content areas of traffic education varies significantly across different age groups. Table 2 provides an overview of participation rates among four distinct age categories. The analysis shows that the age group 41-60 years has the highest total participation, followed by the 26-40 years group. In contrast, the age group above 60 years shows the lowest participation, highlighting a decreasing trend in engagement with age.

Table 2. Participation of various content areas across age groups

Age	Total	TLR	BS	HA	RM	IDP	RSE	EP	RC
18 – 25	16	12	16	9	10	7	11	13	8
26 – 40	39	34	39	25	24	20	30	28	19
41 – 60	49	38	46	28	27	24	35	34	21
Above 60	14	10	14	6	7	7	9	9	6

Basic Driving Skills (BS) emerged as the most commonly engaged content area with a mean score of 28.75 across all age groups (Table 3), indicating that drivers prioritize this foundational aspect of traffic education. Conversely, Road Courtesy (RC) had the lowest mean

score of 13.5, suggesting that this content area receives the least attention across all age groups, despite its critical importance in promoting safer driving environments. The significant engagement in Basic Driving Skills across all age groups emphasizes the universal recognition of its significance. However, the lower participation in Road Courtesy and other critical areas, such as Hazard Awareness (HA) and Risk Management (RM), reflects a gap in comprehensive traffic education. Yahia and Ismail [9] argued that a holistic approach to traffic education is essential, one that equally focuses on all content areas to foster well-rounded driving skills and behaviors.

Table 3. Statistics for different content areas

Con. Areas	Overall	TLR	BS	HA	RM	IDP	RSE	EP	RC
Mean	29.50	23.50	28.75	17.00	17.00	14.50	21.25	21.00	13.50
Median	27.50	23.00	27.50	17.00	17.00	13.50	20.50	20.50	13.50
Std. Dev.	17.25	14.55	16.15	11.11	9.97	8.81	13.18	11.92	7.59
Skewness	0.27	0.05	0.15	0.00	0.00	0.18	0.10	0.12	0.00

The skewness values indicate a nearly balanced distribution, with Basic Driving Skills showing a slight right skew, implying consistent engagement among different age groups. The observed variations in participation across age groups align with existing literature. For instance, Adams [24] highlights that younger and middle-aged drivers often have greater access to updated educational resources and are more likely to engage in structured training programs. This trend is evident in the higher participation rates among drivers aged 26-60, suggesting that these groups are more proactive in seeking continuous education than older drivers [23]. Then, they emphasized the need for targeted educational content that addresses the specific needs of each age group, particularly for older drivers who may face challenges with technology-based learning platforms.

This suggests a need for age-specific adjustments in traffic education programs to ensure balanced engagement across all content areas. For younger drivers, incorporating advanced modules on road courtesy and hazard awareness could enhance their preparedness for diverse driving environments. For older drivers, accessible training formats that accommodate their learning preferences, such as in-person workshops rather than online courses, could improve participation rates. By tailoring educational strategies to meet the distinct needs of each age group, policymakers can ensure that all drivers receive comprehensive and practical training, ultimately contributing to safer roads for all users.

C. Number of Years Driving and Content Areas

The participation of drivers in various content areas of traffic education also varies significantly with the number of years of driving experience. From Table 4, drivers with 2-5 years of experience reported the highest participation in traffic education across most content

areas, with 30 participants, followed closely by those with 6-10 and 11-15 years of experience. In contrast, drivers with less than one year of experience had the lowest participation, highlighting a need for early and continuous engagement in traffic education.

Table 4. Driving years and corresponding participation

Years Driving	Total	TLR	BS	HA	RM	IDP	RSE	EP	RC
Less than 1	3	2	3	2	2	1	2	3	2
2 - 5	30	25	33	18	19	14	22	24	16
6 - 10	27	24	24	18	17	16	22	20	11
11 - 15	28	21	28	15	15	12	19	19	11
More than 15	28	21	26	15	15	15	20	20	14

Similarly, Basic Driving Skills (BS) received the highest engagement across all experience levels with a mean score of 22.8 (Table 5). Similarly, content areas such as Road Courtesy (RC) and Hazard Awareness (HA) showed significantly lower participation, particularly among drivers with more extensive experience. This pattern suggests that while foundational driving skills are prioritized, more nuanced areas of education, like managing risky behaviors and maintaining courteous interactions, receive less focus, especially as drivers gain more experience. The observed trends are supported by literature indicating that driving experience is crucial in shaping engagement with educational content. Peck [25] noted that experienced drivers often rely on their accumulated knowledge, which can lead to complacency and reduced engagement with structured education programs. This finding aligns with the lower participation rates observed among drivers with more than 15 years of experience, who may not feel the need to engage with ongoing education as frequently as newer drivers.

Table 5. Basic statistics for years of driving

	Total	TLR	BS	HA	RM	IDP	RSE	EP	RC
Mean	23.20	18.60	22.80	13.60	13.60	11.60	17.00	17.20	10.80
Median	27.00	21.00	24.00	15.00	15.00	15.00	20.00	20.00	11.00
Std. Dev.	11.27	9.21	11.51	6.07	5.59	6.09	8.44	8.04	5.28

The results indicate a need for targeted interventions that encourage continuous learning regardless of driving experience. Early integration of comprehensive traffic education covering all content areas is essential for newer drivers to develop well-rounded driving habits. For more experienced drivers, refresher courses focusing on advanced topics such as risk management and road courtesy could help address gaps in their ongoing education. Additionally, regulatory bodies could consider implementing mandatory periodic training sessions for all drivers, regardless of experience, to maintain high road safety standards across the board.

D. Impact of Traffic Education

Looking at the impact of traffic education, drivers were sampled according to their effectiveness ratings from 1 to 4, with four being the most effective. The effect of traffic

education on driver behavior varies across content areas. It is influenced by factors such as age, years of driving experience, and the type of driver (private or commercial). Table 6 summarizes the impact ratings of traffic education on drivers across eight key content areas.

Table 6. Impact on drivers in content areas

	TLR	BS	HA	RM	IDP	RSE	EP	RC	Overall
Mean	2.74	3.39	2.85	2.87	2.85	3.05	2.98	2.87	2.84
Median	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Std. Dev.	0.88	0.69	0.80	0.62	0.72	0.66	0.66	1.01	0.85
Skewness	0.09	-0.87	-0.28	-0.55	-0.61	-0.28	-0.42	-0.29	0.14

Basic Driving Skills (BS) showed the highest mean impact score (3.39), indicating that drivers perceived this content area as highly influential in enhancing their driving skills and safety awareness. This corroborates the findings by Scott [6], who noted that core skills training remains the most effective aspect of traffic education. In contrast, Impaired Driving Prevention (IDP) and Road Courtesy (RC) had lower mean impact scores (2.85 and 2.87, respectively), highlighting areas where the perceived effectiveness of traffic education could be improved. This suggests that while foundational skills are well covered, there is a need for more targeted education in behavioral and attitudinal areas that influence safe driving practices.

Further analysis by years of driving experience showed no statistically significant differences in impact ratings, as indicated by the results in Table 7. This suggests that the perceived effectiveness of traffic education is relatively uniform across different experience levels, aligning with the findings by Evans and Wasielewski [26], who argued that the benefits of traffic education are not necessarily diminished by years of driving but rather by the content's relevance and applicability to the driver's current needs.

Table 7. ANOVA for years of driving

	Sum Sq	df	F	PR(>F)
Years Driving	1.16	4.00	0.39	0.82
Residual	82.64	111.00		

The findings highlight the need for differentiated and context-specific traffic education programs that address the unique challenges different driver groups face. For private drivers, continued emphasis on advanced driving skills and risk management can enhance their road safety. However, for commercial drivers, educational content must be adapted to reflect their operational realities, focusing on practical applications and scenario-based learning that directly relate to their daily driving experiences.

Additionally, periodic refresher courses incorporating impaired driving prevention, road courtesy, and emergency procedures could help bridge the gap in perceived impact across

different driver demographics. As Singh and Kaur [16] suggested, traffic education should encompass skill acquisition and a focus on the broader behavioral and psychological aspects of driving, which are critical in fostering safer driving behaviors.

Conclusion

Road traffic accidents remain a significant public health threat globally, with severe consequences for national economies. In Ghana, the growing dependence on road transport has exacerbated the problem, leading to considerable loss of human resources and capital. However, the critical element of road traffic education has been marginalized in efforts to address these challenges.

This study investigated the impact of traffic education on driver behavior, focusing on the differences between private and commercial drivers and the influence of driving experience across various content areas of traffic education. The results highlighted significant disparities in participation and the perceived impact of education programs, demonstrating that private drivers engage more consistently and benefit more uniformly from structured traffic education compared to commercial drivers. The findings also revealed that while foundational content areas like Basic Driving Skills are widely prioritized, critical aspects like Road Courtesy and Risk Management often receive less attention, particularly among experienced drivers and older age groups.

The analysis presents the need for targeted and differentiated educational strategies to address the unique challenges faced by different driver categories. The findings suggest that conventional traffic education programs may be less effective for commercial drivers due to the professional demands and pressures associated with their roles. This calls for developing specialized, scenario-based training that directly addresses their specific needs, such as fatigue management, emergency response, and handling high-pressure situations on the road.

Moreover, the study found that the number of years of driving experience influences the impact of traffic education, with newer drivers benefiting the most from structured learning opportunities. However, experienced drivers often exhibit complacency and resistance to traditional educational approaches. These insights point to the necessity of ongoing, adaptive training programs that encourage continuous learning and reinforce advanced driving skills, even for those with extensive driving histories.

Policy implications of these findings are clear: traffic education should be an ongoing, tailored process that evolves with the needs of drivers at every stage of their driving careers. Mandatory refresher courses, targeted outreach, and flexible training modules that accommodate different learning preferences can bridge participation gaps and enhance the effectiveness of traffic education programs. By fostering a culture of lifelong learning among

all drivers, these interventions can significantly improve driver behavior, ultimately contributing to safer roads and reduced traffic accidents.

While this study provides valuable insights, there are several limitations that future research could address. Conducted exclusively within the Ga North Municipality, the study's findings may not fully represent the broader population of drivers across Ghana or other regions, suggesting that future research should consider a larger, more diverse sample size across multiple regions to enhance generalizability. The evaluation focused on specific content areas of traffic education, such as Basic Driving Skills, Hazard Awareness, and Road Courtesy. Still, it did not include other potentially influential areas like emotional control and advanced defensive driving techniques, which could be explored in future studies to provide a more comprehensive understanding of traffic education's impact. Additionally, implementing a longitudinal approach that tracks changes in driver behavior over time would offer a more robust assessment of the long-term effects of traffic education programs, and also incorporating objective measures, such as driving records or simulator assessments, alongside self-reported data, could further reduce biases and provide a more accurate view of driver behavior.

Conflict of Interest

The authors should declare that there is no conflict of interest.

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