



Impact of safe driving training programs on driver safety culture

Hoda Hassan^{1*}, Ahmed Mohamed Abdel Satar²

¹Faculty of Science, University of Alexandria, Alexandria, Egypt

²Brightskies Geoscience, Petrofayoum Petroleum

Corresponding author: Hoda Hassan (Email: drhodahassan15@gmail.com)

ABSTRACT

This study examines the impact of Safe Driving Programs (SDPs) on driver safety culture and behavior. Road safety remains a pressing global concern in the context of rapid urbanization, motorization, and rising accident rates. Despite advancements in infrastructure and vehicle technology, the human factor continues to dominate accident causation, with unsafe driving behaviors contributing to over 80% of crashes [1]. A quantitative design was employed, utilizing pre- and post-training surveys to assess changes in drivers' awareness, risk perception, accountability, and responsible behavior following participation in an SDP. Results revealed significant improvements across all safety culture dimensions, including reduced risky behaviors such as speeding (↓ 22%), mobile phone use (↓ 31%), and ignoring traffic signals (↓ 18%). Novice drivers demonstrated the greatest improvements, particularly in hazard perception and self-assessment. The findings underscore the importance of embedding SDPs within national road safety strategies, especially in countries such as Egypt, where the World Health Organization (3) estimates over 10,000 annual fatalities. By integrating structured training into licensing systems and reinforcing education with public awareness

campaigns, meaningful progress toward the Sustainable Development Goals (SDGs) can be achieved.

Keywords: Traffic safety; Driver behavior; Safety culture; Safe driving programs; Risk perception.

1. INTRODUCTION

The rapid pace of urbanization, population growth, and technological development has increased global reliance on road transport, intensifying concerns regarding traffic safety. Despite progress in engineering and infrastructure, the human factor continues to dominate accident causation, making it essential to explore road safety from a socio-cultural perspective.

Traffic safety culture reflects the shared values, norms, and behaviors influencing driver decisions and risk perception [2]. Understanding this culture is crucial, as road traffic injuries account for approximately 1.35 million annual deaths worldwide, with children and young adults (ages 5–29) most affected [3]. Low- and middle-income countries bear more than 90% of these fatalities, despite possessing less than half of the world's vehicles.

The United Nations' Sustainable Development Goals (SDGs) emphasize road safety as part of the global development agenda, underscoring interventions such as infrastructure improvement, enforcement of traffic laws, education, and behavioral programs [4].

Central to these efforts is the development of a positive driver safety culture. Key elements include awareness and education, risk perception, responsible behavior,

accountability, peer influence, and continuous improvement. These cultural dimensions collectively shape how drivers behave on the road and interact with others, ultimately influencing accident outcomes.

Traffic collisions, however, remain a multifactorial issue involving human, environmental, vehicle, and infrastructure-related factors. Table 1 summarizes these determinants and corresponding preventive measures.

Table 1. Determinants of Traffic Collisions and Safety Measures

Factor Category	Key Elements	Safety Measures
Human Factors	Speeding, distracted driving, impaired driving, aggressive behavior, signal violations	Driver education, traffic law enforcement, and awareness campaigns
Environmental Factors	Adverse weather (rain, fog, snow), poor road surfaces, low visibility, poor lighting	Infrastructure maintenance, weather preparedness, improved signage, and lighting
Vehicle Factors	Mechanical failures (brakes, tires, steering), poor maintenance, malfunctioning safety features (ABS, airbags)	Routine inspections, regulatory compliance, and driver awareness of vehicle safety
Infrastructure Factors	Poor road design (sharp curves, limited sightlines), lack of signage/markings, inadequate traffic control, unsafe intersections/construction zones	Improved design, consistent signage, robust traffic control, and safety measures in work zones

In Egypt, the WHO (2021) estimates more than 10,000 fatalities annually, with pedestrians comprising 27% of victims. Encouragingly, government investments in expanding the road network since 2014 have coincided with a gradual decline in death rates. Nonetheless, with unsafe driving behaviors contributing to over 85% of crashes [5], structured interventions such as Safe Driving Programs (SDPs) remain critical to strengthening safety culture and reducing accidents.

2. Literature Review

2.1 Driver Behavior and Accident Causation

A substantial body of research highlights the dominant role of driver behavior in traffic collisions. Heinrich [1] estimated that unsafe behaviors account for over 80% of accidents. These include speeding, distracted driving, impaired driving, and aggressive maneuvers. Similarly, the World Health Organization [6] identified human error as the leading contributor to road fatalities, particularly in low- and middle-income countries.

Nævestad, Phillips, and Elvebakk [5] expanded this understanding by linking organizational and cultural factors—such as driving style, training, and workplace safety norms—to accident risk, emphasizing that unsafe practices are embedded within broader cultural contexts.

2.2 Traffic Safety Culture

The concept of *safety culture* extends beyond individual behavior to encompass collective values, attitudes, and norms influencing driver decisions [2]. A positive safety culture is marked by:

- Awareness and education,

- Strong risk perception,
- Responsible driving behavior,
- Accountability,
- Peer influence, and
- Continuous improvement.

Empirical studies demonstrate that communities with stronger safety cultures experience lower accident rates due to shared responsibility and adherence to traffic laws [5]. Education campaigns and structured awareness initiatives are often cited as effective tools for embedding these cultural values into everyday driving practices.

2.3 Safe Driving Programs (SDPs)

Evidence suggests that structured Safe Driving Programs (SDPs) enhance driver competence and reduce accident involvement. These programs emphasize hazard perception, defensive driving, and self-assessment skills [5]. Research consistently shows that participants in SDPs are less likely to commit traffic violations and more likely to adopt safe driving behaviors compared to non-participants.

Gregersen [7] argued that novice drivers often overestimate their abilities, leading to heightened accident risk. SDPs address this gap by promoting realistic self-assessment, strengthening hazard detection, and improving decision-making under complex traffic conditions.

2.4 Global and Regional Perspectives

According to WHO (2021), road traffic deaths disproportionately affect low- and middle-income countries, which account for over 90% of fatalities despite fewer

vehicles overall. Vulnerable users such as pedestrians, cyclists, and motorcyclists represent a large share of these deaths.

In Egypt, WHO (2021) reported 10,263 estimated annual fatalities, with pedestrians comprising 27% of victims. Encouragingly, government-led infrastructure improvements since 2014 have contributed to a reduction in fatalities. However, unsafe behaviors remain prevalent, underscoring the need for behavioral interventions.

2.5. Knowledge Gaps

Despite progress in understanding driver behavior and implementing training programs, challenges remain. Weaknesses in hazard detection and self-assessment persist, especially among novice drivers. Moreover, the long-term sustainability of a positive safety culture depends on continuous reinforcement through education, enforcement, and institutional support.

3. Methodology

3.1 Research design

This study adopted a quantitative research design to evaluate the effect of Safe Driving Programs (SDPs) on safety culture and driving behavior. Pre- and post-training surveys were employed to measure changes in drivers' awareness, accountability, and engagement in risky driving practices.

3.2 Participants

The sample included licensed drivers representing a range of demographics (age, gender, and education levels) and driving experience (novice drivers with fewer than 5 years' experience, and experienced drivers with over 10 years' experience). This distribution allowed for comparative analysis of the impact of the SDP across driver groups.

3.3 Data Collection

Data were gathered through a structured questionnaire composed of three sections:

- A. **Demographic Information** – age, gender, years of driving experience, and driving frequency.
- B. **Safety Culture Indicators** assess awareness, accountability, peer influence, and continuous improvement.
- C. **Driving Behavior** – self-reported adherence to traffic laws, risk perception, and unsafe behaviors (e.g., speeding, mobile phone use, ignoring signals).

All items were measured using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

3.4 Intervention: Safe Driving Program (SDP)

The SDP comprises theoretical and practical components and is designed to enhance hazard perception, defensive driving, and self-assessment skills. Key elements included:

- **Classroom instruction** on traffic laws, accident statistics, and safe driving principles.
- **Simulated driving exercises** to improve hazard recognition and risk assessment.
- **Practical sessions** emphasizing defensive driving techniques, safe following distances, and emergency maneuvers.

3.5. Data Analysis

Survey data were analyzed using descriptive statistics (means, standard deviations) to summarize drivers' attitudes and behaviors. Paired sample t-tests were applied to

evaluate differences between pre- and post-training responses, identifying statistically significant improvements attributable to the program.

3.6. Ethical Considerations

Participants were fully informed of the study's objectives and provided informed consent before participation. Anonymity and confidentiality of responses were ensured. Participation was voluntary, and all procedures adhered to ethical research standards.

4. Results

4.1 Descriptive Statistics

The participant pool reflected diversity in age, gender, and driving experience. Novice drivers accounted for a considerable portion of the sample, while experienced drivers provided a comparative baseline. Pre-training survey scores indicated moderate awareness of safety culture but highlighted deficiencies in hazard perception and self-assessment.

4.2 Program impact

Post-training responses showed statistically significant improvements across all dimensions of safety culture and driving behavior:

- **Awareness and Education:** Greater knowledge of traffic laws and safe driving principles.
- **Risk Perception:** Enhanced ability to anticipate hazards in weather conditions, traffic flow, and interactions with pedestrians.
- **Responsible Behavior:** Increased adherence to following distances, respect for pedestrian rights, and reduced aggressive maneuvers.

- **Accountability:** Stronger acknowledgment of personal responsibility in preventing accidents.
- **Continuous Improvement:** Increased willingness to seek ongoing driver education.

4.3 Reduction in Risky Behaviors

Survey data indicated measurable reductions in self-reported unsafe practices:

- **Speeding** ↓ 22%
- **Mobile phone use while driving** ↓ 31%
- **Ignoring traffic signals** ↓ 18%

These results confirm that the Safe Driving Program had a positive behavioral impact.

4.4 Comparative Insights

Novice drivers exhibited the largest improvements, especially in hazard perception and self-assessment. Experienced drivers also improved, particularly in accountability and peer influence, though the magnitude of change was smaller.

Table 2. Reduction in Risky Driving Behaviors After SDP

Behavior	Pre-Training (%)	Post-Training (%)	Change%
CCCSpeeding	65	43	-22
Phone Use	50	19	-31
Ignoring Signals	40	22	-18

Failure to maintain distance	55	30	-25
------------------------------	----	----	-----

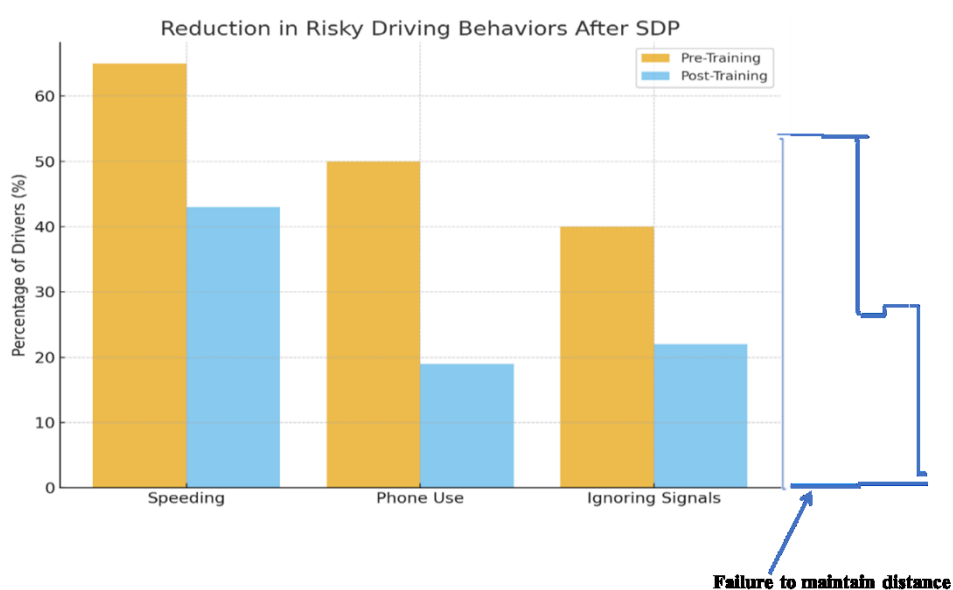


Figure 1. Reduction in Risky Driving Behaviors After SDP

 (Bar chart showing decrease in speeding, phone use, and ignoring signals after training)

4.5 Summary of Findings

Overall, the results demonstrate that the SDP significantly improved safety awareness, risk perception, and responsible driving while simultaneously reducing risky behaviors.

These findings affirm the program's

5. Discussion

The results of this study confirm that Safe Driving Programs (SDPs) significantly enhance driver safety culture and reduce risky driving behaviors. These findings are consistent with prior research, identifying unsafe human behavior as the predominant cause of traffic accidents [1].

5.1 Linking to Safety Culture

The observed post-training improvements in awareness, accountability, and peer influence underscore the central role of safety culture in shaping road user behavior. This aligns with Wiegmann et al. [2], who defined safety culture as a collective commitment to responsibility and continuous learning. The results further demonstrate that embedding safety culture values through structured programs leads to tangible behavior change.

5.2 Novice vs. Experienced Drivers

The study revealed that novice drivers benefited most from the program, particularly in hazard perception and self-assessment. This supports Gregersen's [7] conclusion that novice drivers tend to overestimate their abilities, increasing accident risk. SDPs thus provide critical interventions at the early stages of driving experience, equipping new drivers with realistic risk awareness and defensive skills.

5.3 Behavioral Shifts

The documented reductions in speeding, mobile phone use, and traffic signal violations highlight the effectiveness of targeted training in curbing high-risk behaviors. These outcomes resonate with Nævestad, Phillips, and Elvebakk [5], who emphasized that cultural and organizational interventions can reinforce and discourage unsafe practices.

5.4 Policy Implications

The findings have practical implications, especially for Egypt, where the WHO (2021) reports over 10,000 traffic fatalities annually. While government-led infrastructure improvements have contributed to a decline in fatality rates, addressing the human factor remains essential. Embedding SDPs into national road safety strategies could complement physical infrastructure development and align with Sustainable Development Goal (SDG) targets for reducing road injuries and deaths.

5.5 Limitations

Despite these positive outcomes, the study has limitations. Self-reported survey data may be subject to bias, as drivers could underreport risky behaviors. The sample size and geographic scope may limit the generalizability of findings. Future studies should employ larger, more diverse samples, longitudinal designs, and observational methods to validate these results.

5.6 Contribution to knowledge

By demonstrating measurable improvements in awareness, risk perception, and accountability, this study contributes to the literature, affirming the effectiveness of structured safety programs in shaping safer driver behavior. The results highlight the importance of continuous education as a cornerstone of long-term road safety improvement.

6. Recommendations

6.1 Integration into Licensing Systems

Incorporate SDPs into driver licensing and renewal processes to ensure systematic training across all experience levels.

6.2 Continuous education

Establish mandatory refresher courses to reinforce hazard perception, accountability, and defensive driving practices.

6.3 Targeted Training for Novice Drivers

Develop specialized SDP modules for novice drivers, focusing on risk perception, hazard detection, and realistic self-assessment.

6.4 Public Awareness Campaigns

Complement structured training with national campaigns addressing distracted driving, speeding, and impaired driving.

6.5 Policy Alignment

Embed SDP initiatives within national road safety strategies to align with Sustainable Development Goals (SDGs).

6.6 Future research

Conduct longitudinal studies with larger, more diverse samples and observational methods to validate long-term program effectiveness.

References

1. Heinrich, H. W. (1985). Industrial accident prevention: A safety management approach (5th ed.). McGraw-Hill.
2. Wiegmann, D. A., Zhang, H., von Thaden, T. L., Sharma, G., & Mitchell, A. A. (2002). A synthesis of safety culture and safety climate research. Aviation Research Lab, University of Illinois.
3. World Health Organization. (2021). Global status report on road safety 2021. World Health Organization. <https://www.who.int/publications/i/item/9789240039940>

4. United Nations General Assembly. (2015). Transforming our world: The 2030 Agenda for Sustainable Development (A/RES/70/1). United Nations. <https://sdgs.un.org/2030agenda>
5. Nævestad, T. O., Phillips, R. O., & Elvebakk, B. (2015). Traffic safety culture and prosocial and aggressive driving behaviour – Findings from a Norwegian study. *Safety Science*, 80, 82–95. <https://doi.org/10.1016/j.ssci.2015.07.004>
6. World Health Organization. (2018). Global status report on road safety 2018. World Health Organization. <https://www.who.int/publications/i/item/9789241565684>
7. Gregersen, Nils Petter. “Young drivers’ overestimation of their own skill—an experiment on the relation between training strategy and skill.” *Accident Analysis & Prevention* 28.2 (1996): 243-250.