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Enhancing Road Safety Education through AI-Driven Tools: The Impact of Driving Simulations for Accident Prevention

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ABSTRACT

Road safety is a major global problem; notwithstanding the developments in safety technologies, driver behaviour and error remain integral contributors to accidents, underlining the demand for enhanced driver education. This study analyses the potential use of Artificial Intelligence (AI)-driven strategies to enhance road safety education by fostering philosophical understanding and practical driving skills. Using a quasi-experimental methodology, this research involved 100 qualified oil and petrol tanker drivers who were assigned to two separate groups: the initial group underwent traditional instructor-led training. In contrast, the other group had AI-based instruction using AI-powered driving simulations. Driving experience, accident history, age, and driving hours showed no significant variations between the groups. The study's findings revealed that the AI-based group outperformed the traditional training group in reaction time (2.2 seconds vs. 3.1 seconds), accident frequency (1.0 vs. 3.4), road safety knowledge (22% vs. 12%), and driving errors (4 vs. 11 per simulation). Also, the AI group had 91% accuracy in hazard detection. The findings from the regression analysis revealed that fewer driving errors were strongly linked to a decline in accidents. Hazard detection accuracy and driving mistakes were connected to faster reaction times and increased knowledge. Based on the study's findings, further research is needed on the reliability, practical application, and long-term effects of AI in various driving scenarios.

Keywords: Accident Prevention, AI-driven Tools, Driving Simulation, Road Safety Education and Traffic Accidents.

INTRODUCTION

The rapid advancement of Artificial Intelligence (AI) technologies has brought about transformative changes in various sectors, including banking (Hinge, 2022), education (Ahmad et al., 2021; Hamal et al., 2022), and healthcare (Alzghoul, 2024; Zuhair et al., 2024). One of the most emerging applications of AI lies in the domain of transportation safety, particularly in road safety and traffic accident prevention. According to the World Health Organisation, road traffic accidents remain a leading cause of death and injury globally (Mustapha et al., 2024b). This highlights the urgent need for innovative solutions to mitigate these risks. AI-powered tools, including predictive analytics, driver simulations, autonomous driving technologies, and virtual reality training platforms, have significant potential to enhance automobile student training, improve safety standards, and ultimately reduce traffic incidents. Embracing these innovations, AI enhances the relevance, effectiveness, and outcomes of Technical and Vocational Education and Training (TVET), particularly in automobile training.

Technical and Vocational Education and Training (TVET) institutions and automobile training centres play a crucial role in shaping future drivers and transportation experts (Abdulkadir & Mustapha, 2019). However, Conventional training methods often fall short of addressing complex, real-world traffic scenarios and providing sufficient hands-on experience for high-risk driving situations (Mustapha et al., 2024a; Onatere-Ubrurhe & Ubrurhe, 2024). The integration of AI could enhance the quality of training by offering a more immersive, interactive, and data-driven approach to road safety education. AI tools, for example, can simulate real-time traffic conditions, anticipate hazards, and improve decision-making in a controlled, risk-free environment.

AI-based simulations and predictive technologies are transforming automobile education by allowing drivers to engage with various traffic conditions and improve their decision-making abilities (Xu et al., 2023). These tools enhance technical driving skills and foster a deeper understanding of road safety principles, human error, and accident prevention (Bhardwaj, 2024). For instance, AI-driven programs can simulate hazardous road conditions such as inclement weather or heavy traffic, allowing students to practice in a safe, virtual setting. Similarly, AI-powered predictive models use real-time data from road conditions and traffic patterns to forecast risks, providing valuable feedback to both students and instructors.

Despite these advancements, research on the specific impact of AI-based tools on road safety outcomes, such as accident rates and driver competence, remains limited (Saha, 2024). Additionally, integrating AI into existing training programs poses challenges related to technology adoption, infrastructure, and curriculum development (Mosly, 2024). Successful integration requires not only a robust technical infrastructure but also skilled instructors and updated curricula, which can be challenging to implement without adequate resources.

This paper examines the transformative role of AI-driven tools in enhancing road safety education, with a specific focus on the use of driving simulations for accident prevention. It investigates the effectiveness of AI-driven training tools, evaluates their influence on accident reduction, and examines their integration into educational curricula. The research aims to fill a critical gap in understanding how AI can enhance quality and road safety while also reducing road traffic accidents (RTAs). Additionally, the paper addresses the barriers to AI implementation. It offers recommendations for leveraging these technologies for better learning outcomes and safer road behaviours.

Building on existing research in AI, Education, and transportation, this study contributes to the discourse on technology's role in promoting safer driving practices and fostering innovative transportation. As the transportation sector continues to evolve with autonomous vehicles and innovative infrastructure, the need for effective education that prioritises road safety has never been more pressing. This paper argues that AI has the potential not only to transform the way drivers are trained but also to significantly enhance road safety by equipping drivers with the necessary skills and knowledge to navigate increasingly complex driving environments.

OBJECTIVES

The objectives of this study are to:

- Evaluate the effectiveness of AI-driven tools, particularly driving simulations, in enhancing road safety education within driver education programs.
- Explore how AI-based driving simulations contribute to reducing road traffic accidents by improving the quality of driver training techniques.
- Assess the impact of AI-powered predictive models in identifying high-risk road conditions and preventing accidents within the context of driver training simulations.

METHODOLOGY

Research Design

The study employed a quasi-experimental design to compare two groups of drivers: an AI Training Group, where students were trained using AI-based tools such as AI-powered simulators, and a Control Group (CTG), which received conventional, instructor-led driving education without AI integration. Data were collected before and after the training program to assess the impact of AI-based training, including pre- and post-tests, driving simulation performance metrics, and incident logs. This research design enabled the evaluation of how AI-based training affected student performance and road safety outcomes (Mustapha et al., 2024).

Sample Selection

The study involved 100 registered and licensed oil and gas tanker drivers, with 50 drivers in each of the AI and CTG groups. The drivers were also required to be enrolled in formal automobile education programs and possess basic driving knowledge, but they had no prior experience with AI-based driving simulators. To minimise confounding variables, participants were matched based on age, previous driving experience, and baseline road safety knowledge.

Data Collection Methods

Quantitative data were collected using pre- and post-training assessments, including a road safety knowledge test, which was administered as a multiple-choice questions exam to both groups before and after the training program to assess their knowledge of road safety, traffic laws, and accident prevention strategies. The pre-test measured baseline knowledge, while the post-test assessed the improvement in knowledge after the training. Both groups also participated in driving simulations designed to evaluate road safety performance under various conditions, such as adverse weather, traffic congestion, and sudden hazards. Key performance metrics included reaction time (the time taken to respond to simulated hazards), accident occurrences (the number of accidents), and driving errors (the number of mistakes made, such as failure to signal, speeding, or improper lane changes).

Furthermore, real-world incident data were collected during the training sessions, tracking safety violations, driving errors and accidents, such as failure to stop at red lights or maintain a safe following distance. For the AI group, data were also collected on the performance of AI-based predictive tools, which provided real-time feedback and predictions about traffic hazards, such as sudden braking, pedestrian crossings, and risky road conditions. The accuracy of hazard detection and the students' timely responses were assessed to evaluate the effectiveness of these tools in improving decision-making and safety awareness.

Data Analysis

The collected data were analysed using descriptive and inferential statistical methods. The data were first standardised to ensure equal contribution from all variables, given that different metrics (such as reaction time vs. number of accidents) had different scales. Variables selected for analysis included pre- and post-test scores (to assess knowledge improvement in road safety), driving performance metrics (such as accidents, errors, and reaction time), incident logs (detailing the type and number of safety violations), and the AI group only, the accuracy of predictive models (such as the effectiveness of hazard detection and timely responses).

Descriptive statistics were used to summarise the demographic characteristics of the respondents. Independent t-tests were performed to compare the performance of the AI and CTG across various performance metrics. Multiple regression analysis was conducted using the performance metrics as predictors of road safety outcomes, including accident reduction, knowledge improvement, and simulation performance. Cronbach's Alpha was used to assess the internal consistency of the driving performance metrics and knowledge tests, yielding a value of 0.88, indicating reliability (Robertson & Evans, 2020). The Kaiser-Meyer-Olkin (KMO) Test was conducted to assess the suitability of the data for analysis, with a KMO value of 0.65, which was also considered acceptable (Lu et al., 2024).

Ethical Considerations

The study adhered to standard ethical guidelines. Informed consent was obtained from all participants, who were fully informed about the study's objectives, procedures, and potential risks prior to data collection. Participant data were anonymised, and all personal identifiers were removed to ensure privacy, with data securely stored. Participation was voluntary, and the participants were free to withdraw from the study at any time without facing any penalty.

Limitations

A limitation of this study is sample bias, which was a concern given that the quasi-experimental design did not allow for random assignment, potentially introducing selection bias. However, participants were matched on key characteristics to minimise this bias. The generalizability of the findings was also limited, as the results may only apply to the specific training centres and technologies used in the study and may not extend to all educational contexts.

RESULTS

Descriptive Statistics

The descriptive statistics for the demographic variables of the AI and Conventional groups are as follows: The average age of participants was similar in both groups, with the AI group having a mean age of 24.80 years (± 4.20) and the Conventional group having a mean age of 25.10 years (± 4.40), with no significant difference between the groups ($t = 0.45$, $p = 0.65$). Both groups reported similar levels of prior driving experience, averaging around 12.00 months (AI: 12.30 ± 6.10, Conventional: 12.00 ± 5.80), with no significant difference ($t = 0.35$, $p = 0.72$). Regarding average daily driving hours, the AI group averaged 6.30 hours (± 1.50). In comparison, the Conventional group averaged 6.10 hours (± 1.60), with no significant difference found ($t = 0.48$, $p = 0.65$). In terms of road traffic accidents in the past two years, the AI group reported an average of 0.90 accidents (± 1.20), while the Conventional group reported 1.10 accidents (± 1.30), with no statistically significant difference ($t = 1.02$, $p = 0.31$). The level of education in both groups was similar, with the majority of participants having completed secondary school (AI: 80.00%, Conventional: 78.00%), followed by primary school (AI: 6.00%, Conventional: 8.00%) and tertiary education (both groups at 14.00%). Substance abuse in the past year was reported by 16.00% of the AI group and 18.00% of the Conventional group, with no significant difference ($\chi^2 = 0.11$, $p = 0.75$). These results suggest that the two groups were comparable in terms of these baseline variables. Table 1 shows the summary of the descriptive statistics results.

Table 1: Descriptive Statistics

Variable	AI Group (n = 50)	Conventional Group (n = 50)	Statistical Test
Age (years)	24.80 ± 4.20	25.10 ± 4.40	t = 0.45, p = 0.65
Prior Driving Experience (months)	12.30 ± 6.10	12.00 ± 5.80	t = 0.35, p = 0.72
Average Driving Hours per Day (hrs)	6.30 ± 1.50	6.10 ± 1.60	t = 0.48, p = 0.64
Number of Road Traffic Accidents (past 2 years)	0.90 ± 1.20	1.10 ± 1.30	t = 1.02, p = 0.31
Level of Education			
Primary School (%)	6.00%	8.00%	
Secondary school (%)	80.00%	78.00%	
Tertiary education (%)	14.00%	14.00%	
Substance Abuse (past year)	16.00%	18.00%	χ^2 = 0.11, p = 0.75

Objective 1: Evaluate the effectiveness of AI-driven tools, particularly driving simulations, in enhancing road safety education within driver education programs.

This objective evaluated the effectiveness of AI-driven tools (such as simulations, virtual reality, and predictive analytics) in enhancing road safety education in automobile training programs. The primary measure of effectiveness was the improvement in road safety knowledge, assessed through pre- and post-training tests. Table 2 presents a comparison of road safety knowledge improvement between the AI and Conventional Training Groups.

Table 2: Comparison of Road Safety Knowledge Improvement Between AI and Conventional Training Groups

Group	Pre-Test Score	Post-Test Score	Knowledge Improvement
AI Group	62.00%	84.00%	+22.00%
Conventional Group	60.00%	72.00%	+12.00%
	Statistical Test	t = 10.65, p < 0.001	AI > Conventional

The AI group had an average pre-test score of 62.00%, while the Conventional group scored 60.00% on the baseline knowledge test. After training, the AI group showed a significant increase in knowledge, with a post-test score of 84.00%, compared to the Conventional group's improvement of 72.00%. The AI group exhibited a higher average improvement (22.00%) compared to the conventional group (12.00%), which was statistically significant ($t = 10.65$, $p < 0.001$). These results indicate that AI-driven tools were more effective in improving road safety knowledge compared to Conventional methods.

Objective 2: Explore how AI-based driving simulations contribute to reducing road traffic accidents by improving the quality of driver training techniques.

This objective examined the role of AI in reducing road traffic accidents through enhanced training techniques. Driving simulations were used to evaluate key performance metrics, including reaction time, driving errors, and accident occurrences. Table 3 presents a comparison of driving performance and accident occurrences between the AI and Conventional Training Groups.

Table 3: Comparison of Driving Performance and Accident Occurrences Between AI and Conventional Training Groups

Group	Reaction Time (s)	Driving Errors per Simulation	Accident Occurrences per Simulation
AI Group	2.20	4.00	1.00
Conventional Group	3.10	11.00	3.40
Statistical Test	$t = 5.45, p < 0.001$	$t = 6.02, p < 0.001$	$t = 7.21, p < 0.001$

The AI group had a significantly faster average reaction time of 2.20 seconds compared to the Conventional group, which had an average of 3.10 seconds ($t = 5.45, p < 0.001$). The AI group also made fewer driving errors, with an average of 4 errors per simulation. In comparison, the Conventional group made 11.00 errors, showing a significant improvement ($t = 6.02, p < 0.001$). Additionally, the AI group had fewer accidents, with an average of 1.00 accidents per simulation, compared to the Conventional group's average of 3.40 accidents ($t = 7.21, p < 0.001$). These results demonstrate that the AI group exhibited significantly better performance, with reduced accidents, fewer driving errors, and faster reaction times, highlighting the effectiveness of AI in enhancing automobile training and reducing traffic accidents.

Objective 3: Assess the impact of AI-powered predictive models in identifying high-risk road conditions and preventing accidents within the context of driver training simulations.

This objective assessed the impact of AI-based predictive models in identifying high-risk road conditions and their potential to prevent accidents by improving drivers' ability to anticipate and respond to hazards. Table 4 shows the impact of AI-based predictive models on hazard detection and response times in automobile training.

Table 4: Impact of AI-Based Predictive Models on Hazard Detection and Response Times in Automobile Training

Group	Hazard Detection Accuracy	Response Time to Hazards (s)	Hazard Prediction Accuracy
AI Group	91.00%	1.40	89.00%
Conventional Group	N/A	2.60	N/A
Statistical Test		$t = 6.48, p < 0.001$	

The AI group demonstrated a high hazard detection accuracy of 91.00%, significantly outperforming the Conventional group, which did not use predictive models. Additionally, the AI group responded to simulated road hazards in an average of 1.40 seconds, while the conventional group took 2.60 seconds on average to respond ($t = 6.48, p < 0.001$). The predictive model used by the AI group provided real-time predictions about hazardous situations, such as sudden braking or pedestrian crossings, with an accuracy rate of 89.00%, significantly improving driver safety awareness. These results highlight the effectiveness of AI tools in enhancing hazard detection, improving response times, and increasing safety awareness, demonstrating their potential to reduce accidents through better hazard anticipation.

MULTIPLE REGRESSION ANALYSIS RESULTS

The multiple regression analysis examined the predictors of accident reduction and knowledge improvement in automobile training programs. Below are the results for both models:

Model for Accident Reduction

The regression model for accident reduction explained 62.00% of the variance in accident reduction ($R^2 = 0.62$). Both reaction time ($\beta = -0.25$, $p = 0.02$) and driving errors ($\beta = -0.50$, $p < 0.001$) were significant predictors of accident reduction, indicating that faster reaction times and fewer driving errors were associated with a decrease in accidents. However, knowledge improvement did not significantly predict accident reduction ($p = 0.24$). Table 5 shows the regression model for accident reduction.

Table 5: Regression Model for Accident Reduction

Predictor	Unstandardised Coefficients (B)	Standardised Coefficients (β)	t-value	p-value
Reaction Time (s)	-0.09	-0.25	-2.35	0.02
Driving Errors	-0.19	-0.50	-4.52	<0.001
Knowledge Improvement	-0.05	-0.10	-1.15	0.24
R^2		0.62		

Model for Knowledge Improvement

The regression model for knowledge improvement explained 71.00% of the variance in knowledge improvement ($R^2 = 0.71$). Both driving errors ($\beta = 0.33$, $p = 0.002$) and hazard detection accuracy ($\beta = 0.42$, $p < 0.001$) were significant predictors of knowledge improvement, indicating that fewer driving errors and better hazard detection were associated with more substantial improvement in road safety knowledge. However, reaction time did not significantly predict knowledge improvement ($p = 0.12$). Table 6 shows the regression model for knowledge improvement.

Table 6: Regression Model for Knowledge Improvement

Predictor	Unstandardised Coefficients (B)	Standardised Coefficients (β)	t-value	p-value
Reaction Time (s)	0.04	0.22	1.56	0.12
Driving Errors	0.06	0.33	3.22	0.002
Hazard Detection Accuracy(%)	0.09	0.42	4.57	<0.001
R^2		0.71		

DISCUSSIONS

The descriptive statistics revealed that the demographic characteristics of participants in both groups were comparable at baseline, ensuring that differences in performance outcomes could be attributed to the training methods rather than demographic factors. For instance, the average age of participants was nearly identical across groups, with no significant age difference between the two groups. This finding is important because age has been suggested to affect driving behaviours, with younger drivers typically exhibiting more risk-taking behaviours (Robertsen et al., 2022). However, the similarity in age ensures that this factor does not bias the study's results.

In terms of prior driving experience, both groups reported comparable levels, with an average of approximately 12 months of driving experience, and no significant differences were observed. Prior driving experience has been identified as an essential factor influencing driver behaviour and learning outcomes (Lajunen et al., 2022). Since both groups had similar experience levels, it is unlikely that prior driving experience significantly impacted the differences observed in training outcomes.

Additionally, both groups reported similar average daily driving hours, with no significant difference. The number of hours spent driving daily may influence the acquisition of practical driving skills and road safety knowledge (Lajunen et al., 2022). The results revealed that both groups had similar levels of exposure to real-world driving scenarios, ensuring that their driving experiences were comparable and not confounded by differences in driving frequency.

The reported number of road traffic accidents in the past two years was also similar across groups, with no significant difference. Previous research has shown that drivers with a history of accidents may be more prone to risky behaviours or less receptive to training (Chung et al., 2021). The comparable accident history in both groups minimises the potential bias related to accident history. It helps strengthen the internal validity of the study.

The respondent's education level revealed that most participants in both groups had completed secondary school, with a smaller proportion having attended primary school or tertiary education. These findings are consistent with educational patterns observed in similar driving training studies (Monroe et al., 2020), where secondary school education is typically the most common among drivers. Although education can influence how individuals process and retain road safety information (Shahril & Sidek, 2023), no significant differences were observed between the groups, suggesting that education level did not confound the results.

Finally, both groups reported similar rates of substance use in the past year. However, substance abuse is known to impair driving ability (Cary, 2022); the similar rates between the groups suggest that this factor did not significantly influence the outcomes of the study.

The results of this study provide compelling evidence for the effectiveness of AI-driven tools in improving road safety education, reducing driving errors, and enhancing driver performance. Specifically, the AI group demonstrated significant improvements across all key metrics, including road safety knowledge, reaction time, and accident occurrences. These findings align with previous research that highlights the potential of AI in education, particularly in areas requiring complex decision-making, such as road safety (Bugabuga & Puyo, 2024). The AI-based training tools employed in this study, including simulators and predictive models, facilitated a more dynamic and interactive learning experience, which likely contributed to the significant improvements observed. This is consistent with the growing body of literature suggesting that AI can offer more personalised and engaging learning experiences, leading to better knowledge retention and skill acquisition (Omar et al., 2023).

Regarding knowledge improvement, the AI group outperformed the Conventional group in their pre- and post-test scores. This significant difference indicates that AI technologies can provide more effective learning experiences, potentially due to the real-time feedback and adaptive learning capabilities embedded in AI systems. Studies in other fields, such as medical training and aviation, have similarly demonstrated that simulation-based and AI-enhanced learning tools can significantly enhance knowledge acquisition and practical skills (Bernard et al., 2022; Sapci & Sapci, 2020). The ability of AI tools to simulate diverse and complex traffic situations likely provided the AI group with a more comprehensive and realistic learning experience, enabling them to develop better decision-making skills, a crucial factor in improving road safety (Kim et al., 2024).

In terms of practical driving performance, the AI group showed better outcomes across various metrics. For instance, their faster reaction times and fewer driving errors align with prior research on the benefits of simulation-based training (Xu et al., 2023). The significant reduction in accidents further underscores the potential of AI tools in reducing real-world risks associated with road driving. AI-driven simulators enable learners to experience hazardous conditions, such as sudden braking and adverse weather, in a safe and controlled environment, thereby enhancing their ability to respond to these situations in real-life scenarios. This finding is consistent with studies suggesting that simulation training improves driver safety by allowing individuals to practice and refine their skills in handling emergencies (Prohn & Herbig, 2020).

The AI group also showed superior hazard detection and response times, which can have direct implications for accident prevention. Predictive models, such as the ones used in this study, enable drivers to anticipate hazards and respond more quickly, which is crucial in preventing accidents. The hazard detection accuracy observed in the AI group supports previous studies that have shown that AI-based systems can significantly improve hazard detection and situational awareness (Chaowen, 2024). Providing real-time feedback and predictions, AI tools help drivers develop better anticipatory skills, allowing them to react to dangers before they become critical. This aligns with the concept of "anticipatory driving," which is increasingly being recognised as an essential component of road safety (He et al., 2023).

The regression model for accident reduction revealed that reaction time and driving errors emerged as significant predictors, meaning that faster reaction times and fewer driving errors were associated with a decrease in accident occurrences. These results are consistent with previous research, which has demonstrated that improving reaction time can reduce the likelihood of accidents, particularly in emergencies (Chiang et al., 2022). Faster decision-making in critical driving scenarios allows drivers to react more effectively, potentially avoiding collisions or minimising their severity (Ammour et al., 2022). Similarly, reducing driving errors through training or AI-driven tools is directly linked to improved driving performance and a reduced risk of accidents (Yang et al., 2024).

However, knowledge improvement did not significantly predict accident reduction, which may seem counterintuitive at first. This suggests that while knowledge about road safety is crucial, it does not necessarily lead to immediate improvements in driving performance in real-world conditions. This finding aligns with the idea that practical skills, such as hazard perception and reaction time, play a more substantial role in reducing accidents than theoretical knowledge (Üzümcüoğlu et al., 2020). It also highlights the need for hands-on, immersive training in driving programs, where knowledge can be applied in real-world driving situations.

The regression model for knowledge improvement indicates that the predictors included in the model had a substantial effect on the improvement of road safety knowledge. Driving errors and hazard detection accuracy were found to be significant predictors of knowledge improvement. These results signify that reducing driving errors and improving hazard detection skills are crucial for enhancing road safety knowledge. This finding supports previous studies that emphasise the importance of experiential learning in reinforcing theoretical knowledge (Iskandarova & Ford, 2024; Ummah, 2019). Hazard detection is an essential component of defensive driving. AI-based predictive models have been shown to improve drivers' ability to identify and respond to potential hazards, thereby improving safety awareness and knowledge (Feng et al., 2024).

Remarkably, reaction time was not a significant predictor of knowledge improvement. This implies that although quick reactions are vital for accident reduction, they do not necessarily translate to a better understanding of road safety concepts. This further emphasises the distinction between cognitive knowledge and motor skills in driving behaviour, as improving one does not always lead to improvement in the other (Chen et al., 2024; Pergantis et al., 2024).

CONCLUSIONS

This study demonstrates that AI-driven tools significantly enhance road safety education and practical driving performance compared to Conventional training methods. The AI group demonstrated substantial improvements in road safety knowledge and performed better in simulated driving scenarios, exhibiting faster reaction times, fewer driving errors, and a reduction in accident occurrences. Additionally, AI-based predictive models were found to improve hazard detection accuracy and response times, suggesting that AI can help drivers anticipate and respond to hazards more effectively. These findings highlight the transformative potential of AI in shaping safer, more competent drivers. The study also underscores the importance of incorporating both cognitive and motor skills training into driver education programs to optimise road safety outcomes.

Based on the findings, it is recommended that road safety education programs integrate AI-driven tools, such as simulators, predictive models, and real-time feedback systems, to enhance both theoretical knowledge and practical driving skills. Policymakers and educational institutions should invest in AI-powered platforms to improve drivers' hazard detection, reaction times, and decision-making abilities, ultimately reducing traffic accidents and improving road safety. Driving schools should adopt innovative, technology-driven training methods to meet the evolving demands of road safety. Future research should focus on the long-term effects of AI-based training, examining how improvements in driving performance, hazard detection, and knowledge retention persist over time. Studies should also explore how AI training can be adapted to accommodate different learning styles, cultural contexts, and varying experience levels, while assessing the scalability and cost-effectiveness of AI tools across diverse regions and demographics. Furthermore, future research could investigate the potential of integrating AI with augmented reality (AR) and virtual reality (VR) to create more immersive training environments that simulate real-world driving scenarios.

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