Strategies and Practical Explorations for Reforming Traffic Safety Education in Universities

Baohua Guo[1, 2], Yicong Liu[1], Mengyao Chen[1], Jingyu Zhang[1], Haoyang Zhao[1, *]

[1]School of Energy Science and Engineering, Henan Polytechnic University, Jiaozuo, Henan, China
[2]Jiaozuo Engineering Research Center of Road Traffic and Transportation, Henan Polytechnic University, Jiaozuo, Henan, China
Corresponding Author: Haoyang Zhao

ABSTRACT: *In recent years, improved transportation convenience has been accompanied by a rise in traffic safety incidents among college students, reflecting a widespread lack of traffic safety awareness and deficiencies in current educational approaches. Traffic safety education often remains superficial, failing to foster behavioral change. To address this issue, this study proposes a reformed school-enterprise cooperative education model. A post-intervention survey of 120 participants was conducted to evaluate the model's efficacy. Results indicated significant improvements in both educational and safety outcomes: on the educational front, metrics such as knowledge test accuracy, classroom participation, interest, and satisfaction showed marked increases; in terms of traffic safety, hands-on participation via safety platforms substantially enhanced students' risk perception and safety cognition. The integrated reform model demonstrates effectiveness in improving both instructional quality and students' safety awareness, offering a viable pathway to address existing gaps in traffic safety education.*

KEY WARDS: *Traffic Safety; Higher Education; Campus Security; Educational Model Reform*

I. INTRODUCTION

The proliferation of transportation modes has significantly improved mobility convenience, yet it has also introduced growing safety concerns. On university campuses, speeding, unauthorized carriage of passengers, and cycling without lights at night are commonplace occurrences. Moreover, students frequently engage in risky behaviors such as wearing headphones, making video calls, using mobile phones while walking, or even playing in the middle of roads. The phenomenon of "mixed pedestrian-vehicle flow" and intense traffic has become normalized, leading to a continuous accumulation of traffic risks and hidden dangers[1], resulting in frequent traffic accidents. Most of these incidents are caused by violations of traffic regulations. From 2019 to 2023, the average annual growth rate of traffic accidents involving college students reached 18%–25%. Data on newly licensed drivers by age group indicate that the proportion of young people aged 18–30 has been increasing year by year, rising from 40.80% in 2015 to 59.22% in 2019. Considering driver license application trends and the rising gross enrollment rate in higher education, college students constitute a significant and growing segment of new drivers. Against this backdrop, it is imperative to strengthen the reform of traffic safety education for college students. Cultivating campus traffic safety habits and awareness among students is a fundamental approach to enhancing their safety consciousness, modifying behavioral norms, and reducing campus traffic accidents[2]. However, current academic efforts in traffic safety education exhibit several shortcomings: incomplete coverage of target groups, lack of differentiated educational plans for diverse populations, over-reliance on theoretical traditional lectures, and insufficient immersive experiences, such as simulated driving or accident drills, resulting in low knowledge retention rates. The skill training system is weak, with a notable absence of practical components—key skills such as cycling safety, nighttime riding, and emergency avoidance lack systematic training. There is also inadequate interdisciplinary integration and lagging technology application; practical explorations of technologies like VR simulation and big data analysis in education remain limited, failing to effectively enhance

learning engagement and intervention outcomes. While VR technology can substantially improve individuals' reaction capacity in traffic incidents[3], decision-making ability[4], and instructional quality[5], its application in the educational sector remains insufficient. To address these issues, this paper proposes a reformed model based on home-school-enterprise cooperation, featuring enriched educational content, hands-on participation, and the integration of emerging technologies such as VR to enhance students' practical engagement. This approach aims to resolve the current dilemmas in college traffic safety education, thereby elevating national safety awareness, reducing traffic management costs, and contributing to overall traffic safety.

II. Analysis of Traffic Accident Conditions Among College Students

With the increase in transportation modes, the probability of traffic incidents involving college students has risen significantly. Current traffic safety violations among students can be categorized into the following common types[6], as summarized in Table 1. These behaviors reflect deficiencies in traffic safety awareness, problems associated with shared mobility devices, and inadequacies in campus traffic management. Analyzing these frequent violations and potential risk behaviors can help identify core issues and propose effective solutions

Table 1. **Common Traffic Safety Violations and Their Potential Risks/Consequences Among College Students**

Violation or Risk Behavior	Potential Risks/Consequences
Riding electric bicycles without helmets	Increases the risk of head injury; may be life-threatening in severe cases
Using phones while walking or cycling	Diverts attention and increases the probability of collisions
Cycling or walking on motor vehicle lanes	prone to collisions with motor vehicles, resulting in injuries
Crossing the road without observing traffic signals	May lead to traffic accidents
Wearing dark-colored clothing at night	Reduces visibility to drivers, increasing the likelihood of accidents; Significantly increases the risk of accidents
Riding or driving under the influence of alcohol	Affects pedestrian flow; may obstruct emergency vehicles;Disrupts normal traffic order and can easily cause accidents

2.1 Weak Traffic Safety Awareness

2.1.1 Lack of Attention

Traffic accidents caused by inattention occur frequently among college students. It is common to see students looking down at their phones, wearing headphones, or playing in the middle of roads on their way to and from classes, leading to accidents due to failure to observe approaching vehicles. Such unsafe behaviors reflect personal irresponsibility and also disrupt campus order.

2.1.2 Violation of Traffic Rules

Strict adherence to traffic rules can effectively reduce the occurrence of accidents. However, on university campuses, it is common to find students riding electric bikes without helmets or even traveling in the wrong direction. Studies have analyzed risk factors based on student behavior, highlighting instability during riding, non-compliance with rules, insufficient visibility, and vehicle-related issues as primary contributors. Such behavior reflects a risk-taking mentality and a lack of clear understanding of potential consequences. Violating traffic rules demonstrates disregard for personal safety and indifference to national traffic regulations. Each traffic incident carries hidden dangers; behind every accident, there may be shattered families, potential casualties, economic losses, and threats to social harmony and stability. This underscores the critical importance of prioritizing traffic safety.

2.2 Issues with Shared Transportation Tools

Currently, electric bicycles have become a common mode of transport. Some students disregard safety during rides, with particularly prominent violations during peak hours, such as carrying passengers illegally, competing for right-of-way with vehicles, occupying lanes, speeding, and running red lights[7]. On campuses, students frequently use shared mobility devices, which may suffer from issues like brake failure, non-functional lights, or tire wear. If maintenance personnel do not identify these problems promptly, they can lead to accidents. Furthermore, some students park shared vehicles haphazardly after use, disrupting normal campus order.

2.3 Inadequate Traffic Management in Universities

Some institutions suffer from insufficient numbers and quality of security personnel, as well as lax security measures[8]. Inadequate enforcement of parking and traffic rules, perfunctory safety education, and the absence of

practical drills for students contribute significantly to traffic incidents. Lax control at campus gates in some universities allows unauthorized external individuals to enter on vehicles, posing safety risks to students and staff. This reflects a serious neglect of campus safety. In summary, reliance solely on student self-discipline is insufficient; university authorities must implement effective traffic control measures.

III. Issues in Traffic Safety Education for College Students

3.1 Low Student Engagement

Some universities offer traffic safety education courses, but the majority do not provide such courses, leading to limited exposure to traffic safety knowledge among college students. This results in a general lack of traffic safety awareness, with many students considering traffic accidents to be low-probability events not worth concerning themselves with, and failing to develop good traffic moral qualities. In some schools, teachers use lecturing as the primary teaching method, which creates a teacher-dominated classroom with minimal educational content[9]. The interaction between teachers and students is limited, leading to low student engagement[10]. Additionally, some schools have formalized traffic safety courses with overly simplistic end-of-term assessments. Students often focus on their other academic pursuits and show low engagement with traffic safety education courses, not truly recognizing the importance of traffic safety and lacking incentive systems for participation.

3.2 Single Education Entity

At present, school education is the dominant entity in traffic safety education for college students, with room for improvement in family and societal involvement[11]. The responsibility for student safety lies with the school while on campus, and with society and family outside of it. However, traffic accidents involving college students off-campus are not uncommon, such as those caused by jaywalking, riding without helmets, and drunk driving. One of the reasons for these frequent occurrences is insufficient education. Most families focus on academics and neglect traffic safety education for their children. Traffic education management departments also lack specific methods for traffic safety education tailored to college students.

3.3 Lack of Student Practice

Teachers bear the responsibility of educating and guiding students, and their teaching methods directly or indirectly affect learning outcomes. The new curriculum reform requires teachers to integrate knowledge with practice and focus on practical experience. However, the traditional "meeting-style, lecture-style" safety education model is limited in form, and most traffic safety education courses in schools rely on verbal instruction or video learning, lacking interactive and practical experiences. This makes students' learning lives dull and fails to spark a strong interest in traffic safety education courses, preventing them from firmly committing traffic safety education to memory, which greatly reduces the effectiveness of such education.

IV. Measures to Strengthen Traffic Safety Education for College Students

### 4.1 Enhance Course Design to Improve Educational Safety

Universities should actively offer courses on traffic laws and regulations to universally enhance college students' traffic moral literacy. By combining elective and required courses and additionally implementing a credit system, students' understanding and mastery of traffic safety can be assessed. Establishing a reward and punishment mechanism, such as selecting "Traffic Safety Stars", can motivate college students' enthusiasm for traffic safety education and improve educational safety.

With the rapid development of technology in recent years, teachers can change their teaching methods and introduce new teaching technologies to enhance teaching effectiveness[12]. As autonomous driving technology and smart traffic become more integrated into daily life, course design can be strengthened by incorporating these topics, keeping up with current events to increase students' attention to traffic safety. Universities should hold knowledge lectures on traffic safety to raise students' awareness of traffic regulations, traffic signs, accident prevention, and the necessity of traffic safety. Teachers can use case analysis during lectures to guide students in thinking about the root causes of traffic accidents and improve their traffic safety capabilities. Students can engage in group discussions, sharing their views on traffic safety and personal experiences or observed traffic accidents, thereby gaining a deeper understanding of traffic safety through mutual exchange.

4.2 Multi-Subject Joint Management Model

The safety of students is jointly maintained by families, schools, and society, and the school-enterprise cooperation education model has better results compared to traditional education models[13]. For college students' traffic safety education, a multi-subject joint management approach is advocated, as shown in the flowchart of the

family-school-society joint management model in Figure 1. Families should set an example, such as parents adhering to traffic safety laws and regulations while driving, and maintaining good driving habits like "not using mobile phones while driving", and participating in traffic safety science popularization activities with their children. Schools should also enhance their control by regularly holding meetings with the security department to report campus accidents and their root causes, identify issues with campus traffic safety, and propose amendments. Additionally, increasing the number of security patrol cars and strengthening campus management, as well as using campus media to disseminate traffic safety knowledge, are important. On the societal level, traffic police departments should regularly train the school security departments, review traffic accidents on campus, issue new policies or adjust existing ones, and propose optimization measures. They can also use social media to spread traffic safety knowledge and hold traffic safety science popularization and explanation contests to enhance college students' traffic safety awareness. Families, schools, and society should jointly promote traffic safety education to form a synergistic educational effort.
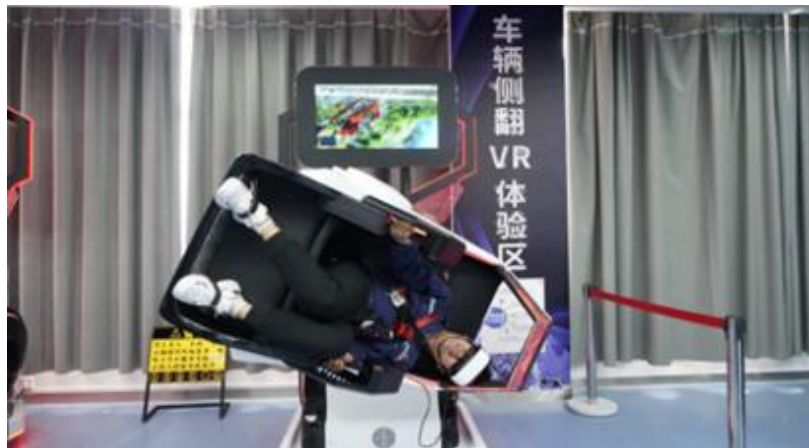
Figure 2: VR Vehicle Rollover Simulation Experience
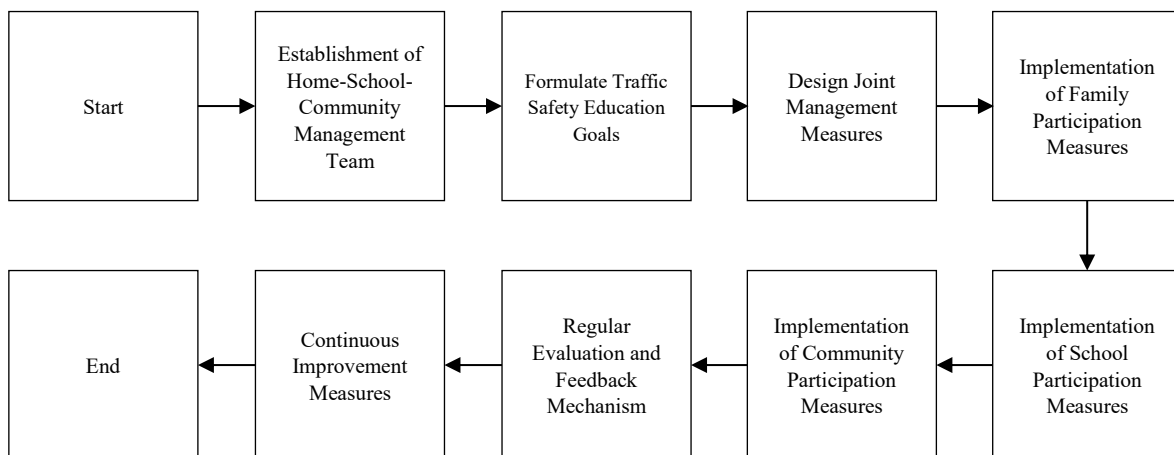
Figure 1: Flowchart of the Multi-Stakeholder Collaborative Management Model

4.3 Organizing Extracurricular Activities: Practical Experience Yields True Understanding

To truly understand and master knowledge, one must apply what they have learned to real-life situations—continuously exploring and enriching their knowledge system through practice[14]. The focus of teaching should shift to an "immersive, interactive, and experiential" model to bridge the gap between awareness and action. Universities are advised to expand traffic safety education extracurricular activities, such as organizing college students to visit traffic safety education bases. Through participation in safety campaigns, combined with case analysis and simulation drills, students can enhance their traffic safety knowledge and emergency response capabilities. Beyond visual immersion, VR technology can provide multi-sensory experiences for students via surround sound and haptic feedback[15]. As shown in Figure 2, VR technology recreates virtual traffic scenarios with realistic physical sensations and immersive visual effects, allowing students to deeply engage with virtual

environments and deepen their understanding of traffic laws and regulations. Additionally, collaborations with traffic management departments can enable students to experience traffic command firsthand. This hands-on involvement helps students grasp the entire process of traffic management, strengthens their awareness and respect for traffic safety, and reinforces practical learning.

V. Traffic Safety Education Reform in Higher Education

5.1 Research Design

5.1.1 Participants and Implementation Period
The study recruited 120 first-year postgraduate students admitted in 2023, majoring in traffic-related disciplines at a university; 68 were male and 52 were female, 72 held a driving licence and 48 did not. The intervention lasted one academic semester (18 weeks) and was delivered in three sequential stages: "theory induction (12 contact hours) – scenario-based task drill (12 contact hours) – closed-loop instructional assessment (12 contact hours)".

5.1.2 Data Collection
Data were collected through questionnaires, knowledge tests, on-site observation, and video analysis. For the "reaction" dimension, a questionnaire was distributed at the end of the course, and 118 valid responses were returned, covering course interest, perceived immersion, and device usability. For the "learning" dimension, a 30-item online knowledge test covering traffic regulations and emergency response was administered before the course (pre-test) and after the course (post-test). For the "behaviour" dimension, students' performance during the scenario-based drills was video-recorded and coded for mission-completion rate and correct-action rate.

5.2 Results

5.2.1 Students' Interest and Satisfaction in Learning
The questionnaire showed that the mean interest in the traffic safety course was 3.85 on a five-point scale (1 = very uninterested, 5 = very interested). Agreement rates were 71 % for immersion ("the course gave me a sense of being on the scene"), 68 % for device usability, 66 % for satisfaction with course pace and 60 % for timeliness of feedback, all in the upper range. Only 8 % of the students reported mild dizziness when using the VR headset; the problem was eliminated by limiting each session to 15 minutes and offering an alternative task, such as watching case videos.

5.2.2 Knowledge Mastery Level
The pre-test revealed an overall accuracy of 52.3 % for traffic safety knowledge, with 48.2 % for first-on-scene procedure and 50.5 % for high-speed tyre-burst handling. The post-test overall accuracy rose to 75.8 %, with the first-on-scene procedure improving to 73.3 % and high-speed tyre-burst handling to 75.4 %. Error analysis indicated that before the course, students mainly struggled with "emergency response sequence" and "rules for special scenarios"; the proportion of such errors decreased by 23 % after the course, demonstrating that the content and teaching methods effectively improved knowledge acquisition.

5.2.3 Practical Skills
During the scenario-based drills as shown in Table 2, both mission-completion rate and correct-action rate improved markedly. In the initial drill, the first-on-scene procedure achieved a completion rate of 62 % and a correct-action rate of 58 %, while the high-speed tyre-burst drill achieved 65 % and 60 % respectively. After targeted coaching and repetition, the first-on-scene completion rate rose to 92 % and the correct-action rate to 88 %; the high-speed tyre-burst completion rate rose to 90 % and the correct-action rate to 85 %, with sequential errors declining significantly. For example, 35 % of students made the error of "jerking the steering wheel" in the initial high-speed tyre-burst drill, but after repetition, this error dropped to 5 %.

VI. Summary

At present, with the in-depth reform of educational concepts, for college students, mastering traffic safety knowledge is indispensable whether on campus or off campus. This paper conducts an in-depth analysis of the current situation of traffic safety education in higher education institutions and proposes corresponding educational reform models for the deficiencies in academic research and the problems existing in the actual situation.

***Table I.* Effectiveness of Scenario-Based Task Drills: Changes in Various Indicators**

Indicator	Result	Key Points
Immersion/Interest(Agreement Rate > 4)	Agreement Rate 62%–71%; Mean 3.68–3.85	Both immersion and interest are in a relatively high range
Procedure Confidence (Mean Value)	Mean Value 3.62–3.81	Good awareness of norms and application confidence
Equipment Convenience/Discomfort Control (Agreement Rate)	Equipment Convenience 68%, Discomfort Control 64%	Good usability and comfort
Classroom Pace/Feedback (Agreement Rate)	Classroom Pace 66%, Feedback Timeliness 60%	Effective organization and feedback
Knowledge Test Accuracy (C1–C5)	Overall 75.8%	Weaker areas: First accident handling 73.3%, High-speed tire blowout 75.4%
Satisfaction/Recommendation Intention (Mean Value)	Satisfaction3.78, Recommendation Intention 3.69	Overall reputation is good

There are the following key issues in college student traffic safety education: low student participation: the course is formalized, lacks incentives, and students are not interested. Single educational subject: over-reliance on schools, with weak family and social participation. Lack of practical links: traditional teaching is mainly theoretical, lacking immersive experience. Superficial safety awareness: students lack awareness of risks, and the behavior transformation rate is low. Corresponding educational reform models are proposed for these issues: introducing a combination of elective and required courses, increasing credit incentive mechanisms. Integrating VR technology, case analysis, and group discussions to enhance interactivity. Multi-subject joint management to establish a school-community collaboration mechanism: schools strengthen education and publicity, and enterprises provide support. Innovative practical teaching organizes activities such as VR simulation, traffic command experience, and base visits to enhance practical skills. The empirical research indicates that the integrated reform framework of "curriculum system optimization + multi-subject collaborative management + immersive practical teaching + closed-loop evaluation mechanism" constructed in this paper can effectively enhance the effectiveness of traffic safety education in higher education institutions: In the reaction dimension, students show high interest and satisfaction with the course, and the immersive teaching method increases student engagement; In the learning dimension, students' mastery of traffic safety knowledge has significantly improved, especially in knowledge points related to emergency response; In the behavior dimension, students' practical operation skills and emergency response capabilities have been enhanced, effectively alleviating the problem of "knowing but not doing". Through questionnaires, knowledge tests, and behavioral observations of 120 research subjects, the reform has significant effects: in the educational aspect, the average course interest has risen to 3.85, the immersion agreement rate has reached 71%, and the classroom rhythm satisfaction is 66%. This reflects a high acceptance of the teaching model and an increased motivation for student participation. In terms of traffic safety awareness, the overall correct rate of knowledge tests has increased from 52.3% to 75.8%, the correct rate of accident first response has increased from 48.2% to 73.3%, and the correct rate of high-speed tire blowout handling has increased from 50.5% to 75.4%. Weak links have been significantly improved, and the depth of theoretical cognition has been enhanced. The discomfort of VR equipment has dropped from the initial feedback to 8%, the error rate has decreased by 23%, and the error rate of "abrupt steering" has dropped from 35% to 5%. This educational model reform includes strengthening curriculum design, multi-subject joint management models, and practical reforms, providing a reference for further reform and development of traffic safety education for college students. In the future, it is necessary to further deepen traffic safety education for college students, so that education can truly achieve the ultimate goal of "knowing risks, respecting life, and following rules". Enhancing college students' traffic safety awareness promotes personal healthy development and creates a harmonious and stable social environment. Therefore, it requires the joint efforts of all sectors of society to continuously explore and innovate educational methods to ensure that college students can fully master traffic safety knowledge and protect their own and others' lives and property safety.

Due to actual conditions and time constraints, there are deficiencies in this research: some students' handling abilities in complex traffic scenarios still need to be improved; the operational efficiency of the collaboration mechanism needs to be further optimized. Subsequent improvements to the reform plan are needed to address these issues, such as increasing practical exercises in complex scenarios and continuously improving the quality of education.

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