A MODEL OF LIFELONG TRAFFIC EDUCATION AS A FOUNDATION FOR PROACTIVE ROAD SAFETY

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Abstract

The traditional approach to traffic safety, which primarily relies on repressive measures and the training of candidates only upon reaching adulthood, shows limited results regarding the long-term change in participant behavior. This paper advocates the thesis that traffic education must be a continuous process starting in early childhood, when an individual first enters the traffic ecosystem as a pedestrian. By analyzing proactive education methods, the study explores how the early development of risk perception directly correlates with later responsible behavior as a driver. A special focus is placed on adolescence as a critical period for preventing risky behavior and "reckless driving" through professional lectures that precede formal training in driving schools. Concluding considerations indicate that the integration of traffic ethics into the primary and secondary education systems is the only sustainable way to systematically raise the level of traffic culture and reduce fatal consequences on the road network.

1. INTRODUCTION

The current educational system treats traffic education as marginal, secondary content that is implemented through just a few isolated and theoretical lessons during the school year, and through the final, often exclusively pragmatic training of driver candidates. This fragmented and discontinuous approach overlooks a fundamental fact: an individual becomes an active participant in a complex traffic ecosystem from the moment of birth and their first steps in public space, not by the act of acquiring a driver's license. The lack of continuous education and early traffic socialization directly correlates with a low level of general safety and frequent deviant behavior among road network users, who perceive traffic rules as an imposed repression rather than an ethical standard of movement. A particular safety challenge is the child population, whose behavior patterns are naturally spontaneous, and whose cognitive processes are intrinsically unpredictable to other participants. Children in the developmental phase do not possess the biologically developed ability to precisely and simultaneously evaluate the speed and distance of a moving vehicle, nor can they predict the kinetic outcome of a potential conflict in space. Therefore, it is imperative that a proactive learning model tracking the psychophysical development of the child be implemented through the formal educational system. In the 21st century, traffic has evolved into a comprehensive, high-tech phenomenon that permeates a person's entire lifespan, which demands the development of a fundamental traffic culture that is not acquired by mere memorization of signs, but is internalized as a set of natural, self-evident, and morally binding norms of behavior. The ultimate goal of such a reformed, multidimensional approach is to create a system in which learned safe behavior ceases to be an instinctive avoidance of punishment and becomes an inseparable, integral part of an individual's personal identity and daily routine. Only through early, systematic, and scientifically grounded education is it possible to create stable cognitive maps in young participants, effectively suppress behavioral unpredictability, and transform the current, delayed reactive safety model into a sustainable proactive civilizational standard that preserves human lives.

2. EARLY DEVELOPMENT (PRESCHOOL AND ELEMENTARY SCHOOL)

During the developmental phase encompassing preschool and early school age, children attain a high degree of motor skills that enable them to execute complex physical actions, such as sudden running, jumping, and rapid, non-linear changes in direction. An additional challenge is presented by the increasingly frequent use of micromobility devices, such as scooters, bicycles, and rollerblades, which allow the child to develop speeds that significantly exceed their perceptive capacities. Although physically exceptionally agile at this age (Lindov, 2008), their cognitive and neurological development has not yet reached the level necessary for the precise and simultaneous perception of time, space, and depth. What is critical from an engineering standpoint is the child's inability to adequately assess the kinetic energy of a moving vehicle, as well as a lack of understanding of the concept of a motor vehicle's stopping distance under various speeds and road conditions. This profound mismatch between physical mobility and cognitive immaturity results in behavior patterns defined in traffic engineering as spontaneous and extremely unpredictable. Such unpredictability acts as a permanent generator of high risk, because drivers often cannot timely anticipate a child's reactions, which are guided by an immediate impulse or external stimulus rather than the logic of the traffic flow. By introducing proactive learning at this stage, the goal is to bridge this gap by developing defensive mechanisms in children, teaching them that their physical speed must always correlate with a visual confirmation of safety, thereby directly reducing the probability of conflict situations in school and playground zones.

Current legislation primarily focuses responsibility on motor vehicle drivers; however, engineering practice points to serious challenges

caused by rapid and often unplanned urbanization. The construction of dense road networks in the immediate vicinity of educational institutions, playgrounds, and parks creates high-conflict zones. An additional complicating factor is visual barriers in the form of vehicles parked by residents and visitors. Due to their low anthropometric height, children are often completely obscured by parked vehicles, and their reflexive running out onto the roadway (e.g., chasing a ball or other object) leaves the driver with minimal reaction time, which frequently leads to accidents with fatal consequences (Lindov, 2008). In addition to cognitive limitations, physiological specificities of the sense of sight represent a significant risk factor in childhood. It is documented that peripheral vision in children is underdeveloped, with their horizontal field of vision being approximately 30% narrower compared to adults. This phenomenon, known as “tunnel vision” (Lindov, 2008), directly prevents children from adequately spotting objects and motor vehicles approaching from the side. From a traffic safety perspective, this physiological barrier means that despite being physically present on or near the roadway, a child is often unaware of an oncoming hazard outside their narrow focus of attention. This limited visual perception, combined with rapid and unpredictable movements, further confirms the necessity of engineering protective zones around school facilities and the need for intensive education on the rules of visual verification of the traffic flow before stepping onto the roadway. (ReLoaD 2, 2024)

From the aforementioned risks, it is clear that establishing institutional and operational synergy between traffic engineering, forensic experts, and the educational system is of crucial importance. Traditional, passive education must be replaced by systemic, interactive modules and continuous professional lectures that proactively raise the level of safety culture from the earliest age. The focus of such a model must be primarily directed toward training vulnerable, non-motorized participants (pedestrians and cyclists) (Mehanović, 2017), with a special emphasis on developing the ability to early recognize latent hazards on the roadway, those threats that are not immediately visible but are predictable through an understanding of traffic processes.

In addition to acquiring the visual identity and meaning of traffic signage, with a particular emphasis on road markings and pedestrian crossing zones, children must adopt the internal logic of the traffic system. This implies understanding cause-and-effect relationships, such as the impact of weather conditions on visibility or the importance of establishing eye contact with the driver. Raising the overall level of traffic literacy and ethics represents not just a pedagogical goal, but a critical engineering strategy for risk reduction. In a society where traffic is a dominant factor of daily life, literacy in this domain becomes a necessary tool for preserving human lives within a high-conflict technical environment that every individual, without exception, daily and inevitably encounters.

3. ADOLESCENCE (HIGH SCHOOL)

Modern driver candidate training practices, which are legally limited to reaching the age of majority, prove to be chronically delayed and insufficient for the effective prevention of deviant behavior among the youth within the current social context. The traffic education system within high school institutions should not be reduced to ad-hoc lectures or a marginal mentioning of legal regulations.(Mojoj BiH, 2024) On the contrary, it must be established as a continuous curriculum of traffic ethics, in which formal driving school training represents merely the final, technical phase, the crowning achievement of a multi-year process of adopting responsible behavior patterns. Introducing traffic education into high schools allows adolescents to gradually prepare for the role of a driver through risk analysis while they are still in the status of pedestrians or cyclists. This approach prevents the occurrence of "cultural shock" upon first entering a motor vehicle, as the candidate already possesses a developed attitude toward social responsibility and the consequences of risky behavior. Without this prior foundation, driving school training

remains reduced to the mere mastering of technical vehicle operations, while a fundamental shift in awareness is absent, directly generating young drivers who are technically capable but ethically and safety-wise underdeveloped.

In modern society, it is essential to create a new paradigmatic framework in which possessing a driver's license is no longer perceived as a mere, self-evident right acquired by biological majority. On the contrary, operating a motor vehicle must be positioned as a social privilege and a high responsibility, based on previously demonstrated, deep-seated knowledge and the cognitive maturity of the individual. This level of maturity cannot be achieved through an accelerated driving school course, but exclusively through the long-term integration of the traffic engineering profession into the high school system, thereby separating the learning process from the mere acquisition of a license. Only through systemic education can we ensure that new drivers enter the road network with a developed instinct for defensive driving, a skill that implies the constant anticipation of others' mistakes and proactive action to avoid conflict.

A key element of this process is developing traffic empathy, especially toward vulnerable participants such as children, the elderly, and cyclists. When a candidate learns through high school education to observe traffic from a pedestrian's perspective, they develop a natural tendency as a future driver to reduce speed in conflict zones, not out of fear of sanctions, but due to an internal sense of responsibility. The implementation of such an environment transforms the traffic culture from reactive (punishment after an accident) to proactive (accident prevention through ethics). In this way, the educational system becomes the foundation of proactive safety, creating generations of drivers who understand that their freedom of movement ends where the endangerment of another person's life begins. This approach is not merely a pedagogical ideal, but a necessary engineering measure for drastically reducing road mortality rates.

The period of adolescence is biologically and psychologically characterized by an increased affinity for risky situations and a tendency to test established boundaries. On the roads of Bosnia and Herzegovina, this phenomenon manifests itself through an alarming number of adolescents operating motor vehicles before acquiring the legal right to do so. As self-taught and inexperienced operators, these individuals enter complex traffic flows without an elementary knowledge of the rules of right-of-way or the meaning of vertical road signage. When the consumption of psychoactive substances and alcohol is added to this, despite legal prohibitions on distribution to minors, it creates an extremely high risk for traffic tragedies with irreversible consequences.

A specific aspect of risk within the adolescent population is the phenomenon of social validation, namely the need to seek approval within the primary peer group. During this developmental period, motor vehicles are frequently perceived as tools for achieving a higher social status and demonstrating dominance. This perception directly generates high-risk behaviors, including extreme speeding, aggressive overtaking, and performing dangerous maneuvers in populated areas. This problem is further compounded by the interaction within the vehicle itself. It has been proven that the presence of peers in a vehicle exponentially increases a driver's propensity for risk-taking, while passengers concurrently expose themselves to direct, life-threatening danger by performing actions that compromise vehicle stability or their own safety, such as leaning out of windows, climbing onto a moving vehicle, or distracting the driver. From an engineering standpoint, these actions drastically alter the driver's distribution of attention and increase reaction time in critical situations. Under such circumstances, the vehicle cabin becomes a high-distraction zone where the focus is not on the traffic flow, but on the social dynamics inside the car. Precisely because of this, education must also address the role of the passenger, developing an awareness that passive participants in a vehicle directly contribute to the (in)security of the drive. The goal is to transform

peer influence from negative (encouraging risk) to positive (deterring unsafe actions), thereby creating a collective system of responsibility within the group.

To suppress these negative trends, it is essential to establish a strong correlation between the traffic engineering profession, the educational system, and forensic traffic accident reconstruction experts. Regular workshops (ReLoaD 2, 2024) and educational sessions must not be merely theoretical; they must include case studies from forensic practice, visual depictions of real-life consequences, and simulations of the forces acting during a collision. The goal of this proactive approach is to transform the mindset of young people from perceiving driving as entertainment to understanding vehicle operation as a responsible task within a high-risk system. The involvement of forensic traffic experts in educational processes represents a key step toward achieving a higher degree of risk objectification. Through this approach, abstract legal rules receive their real, physical confirmation. Direct insight into photo documentation from accident scenes, the analysis of vehicle deformations, and precise calculations of kinetic energy and stopping distances create a powerful reality factor that is necessary for correcting the behavior of young traffic participants.

For the adolescent population, which is developmentally characterized by a cognitive distortion known as the "sense of personal invulnerability, a direct collision with reality through forensic evidence represents one of the most powerful psychological correctives. The visual presentation of the exact consequences of speed inappropriate for conditions, loss of vehicle control, or driving under the influence of psychoactive substances ceases to be mere theory the moment it is backed by expert forensic analysis. A key element of this methodology is the demystification of driving as harmless entertainment through the interpretation of bio-mechanical forces generated during a collision. When an expert explains and visualizes how kinetic energy, which increases with the square of the speed is transferred to the human body and internal organs within a deformed vehicle cabin, the adolescent gains insight into the physical relentlessness of a traffic accident. This form of education goes beyond mere intimidation; it is aimed at developing critical thinking and a deep understanding of the irreversible consequences that occur in a fraction of a second due to inattention, overestimating one's own abilities, or conscious violation of regulations. By utilizing authentic photo documentation from accident scene investigations and the calculation of brake skid marks, the educational process is transformed into a scientific-research session that forces the young person to face the fact that the laws of physics make no concessions to inexperience or youth. The goal is to create a cognitive association between a risky action and its physical cost, thereby taking a preventive approach to curbing impulsive driving decisions.

4. CONTINUITY OF LEARNING (DRIVING SCHOOL)

The process of driver candidate training, although strictly defined by law, suffers from a series of systemic anomalies in practical application that directly jeopardize public safety. The first level of triage, the medical examination, which should serve as a rigorous barrier to eliminate psychophysically unfit candidates, is frequently reduced to a mere administrative procedure. Through superficial examinations and the neglect of detailed diagnostic procedures, a space is cleared for the conscious concealment of physical and psychological anomalies. Candidates, motivated by documentation expiration dates or the desire to acquire their license quickly, often withhold relevant health issues, which results in the issuance of medical certificates to individuals whose abilities do not meet the demands of operating a motor vehicle under complex conditions.

Following the first aid phase, the process continues through theoretical training, which in contemporary practice faces the critical phenomenon of rote learning. Instead of developing a cognitive understanding of traffic logic, ethics, and situational intelligence,

candidates primarily rely on exam question databases that they master through repetitive methods. This approach results in the mere reproduction of correct answers without a fundamental interpretation of the rules of right-of-way, the complexity of traffic flow dynamics, or the anticipation of potentially conflict-ridden situations.

Institutional pressure aimed at achieving a higher throughput of candidates, combined with the drive of driving schools to maximize profits and minimize operational costs, creates an environment where quantity is prioritized over quality. Instructors and lecturers rarely dedicate time to thoroughly explaining cause-and-effect relationships in traffic, focusing exclusively on achieving high pass rates on tests. This reduction of the educational process to the level of technical exam training results in candidates who possess theoretical information but lack situational awareness.

Consequently, we obtain drivers who recognize a sign in theory, but in practice do not understand the danger that the sign is meant to prevent. This gap between learned and applied knowledge becomes evident within the very first independent miles of driving, where a lack of understanding of system dynamics leads to wrong decisions and the endangerment of general safety. Without transforming theoretical training from a memory-based into an analytical process, driving schools remain generators of participants who view traffic as a static database of rules rather than a dynamic and high-risk system. The critical point of the process is practical training, where serious manipulations regarding the required hours of instruction have been documented. The practice of logging the legally mandated number of hours into official documentation, while in reality conducting significantly less training, results in a deficit of practical competencies. This mode of operation creates "artificially prepared" drivers who possess a license, but not the skill to operate a vehicle in crisis situations. When these structural deficiencies combine with the prior lack of traffic education throughout elementary and high school, we get a population of young drivers without a developed traffic culture or sense of responsibility. The ultimate consequence of these cumulative failures is a statistically evident increase in traffic accidents involving precisely young drivers (Ejubović, 2026) , whose inadequate training and lack of safety awareness become a fatal threat to the road network. Candidates who go through the training process via the method of mechanical memorization of tests, along with an inadequate, reduced amount of practical driving hours, generate a high degree of latent danger within the traffic system. When this deficit of knowledge and skills is combined with medical certificates issued without rigorous diagnostics, we get a driver profile operating within the system without a fundamental understanding of its rules, without a developed motor memory for vehicle operation in critical situations, and potentially with physical limitations that compromise their reaction. From an engineering and forensic standpoint, this problem becomes visible only retrospectively—that is, after a traffic accident occurs. A forensic traffic expert, when analyzing the circumstances of an event, starts from the assumption that the participant is psychophysically healthy, adequately trained, and legally capable of operating a vehicle, as mandated by the official documentation (driver's license and medical report). However, the expert analysis reveals flawed judgment and inadequate actions that are a direct byproduct of poor training. The expert sees a technical error, an inadequate braking reaction, or a misjudgment of another vehicle's speed, whereas the true cause of that error remains deeply hidden within a superficial system of education and certification. This creates a closed loop in which institutions produce unsafe drivers, and the traffic engineering profession deals with the consequences of their mistakes, while the systemic cause (poor training and examination) remains outside the scope of direct accountability.

CONCLUSION

The analysis of the current state of traffic safety in Bosnia and Herzegovina indicates that the root of the high risk levels and fatal consequences on the road network does not lie exclusively in infrastructural deficiencies, but rather in a deep

deficit of traffic culture and systemic failures in education. Shifting from a reactive to a proactive safety model requires a radical reform in the educational approach, which treats traffic ethics as a lifelong process rather than an administrative hurdle prior to reaching the age of majority.

In early childhood, physiological and cognitive limitations such as "tunnel vision" and inadequate spatial perception must be compensated for by engineering protective zones and intensive pedagogical training. During adolescence, proactive education supported by forensic evidence and the experience of accident reconstruction experts must serve as a psychological corrective for the natural inclination toward risk-taking and social validation. Finally, the driver certification process in driving schools must be freed from profit-oriented practices, superficial medical examinations, and rote learning, ensuring that a driver's license is not just a formal document, but a genuine confirmation of competence and responsibility.

In conclusion, as long as the system produces drivers who are "capable" only on paper, the traffic engineering profession and forensic experts will deal exclusively with managing the consequences, while the root causes remain untouched. The integration of traffic culture into all levels of the educational system is the only sustainable way toward creating a safe environment where traffic rules become a reflex and human life becomes the ultimate priority. Engineering solutions and legal regulations reach their full potential only when supported by an educated and conscious individual.

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