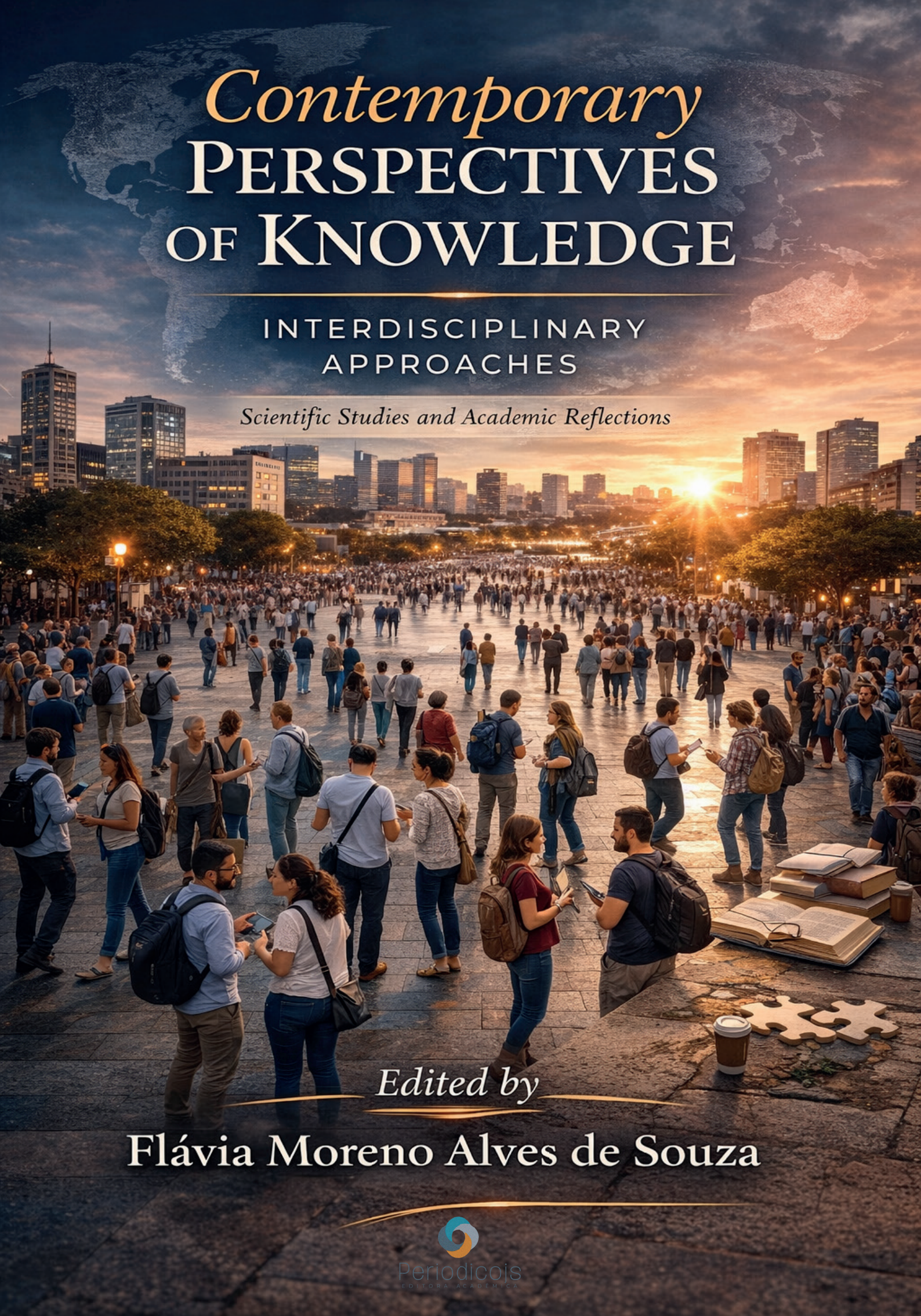




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TRAFFIC SAFETY EDUCATION AS A TOOL FOR CRASH PREVENTION: AWARENESS STRATEGIES IN SCHOOLS, WORKPLACES, AND COMMUNITIES

Chapter



TRAFFIC SAFETY EDUCATION AS A TOOL FOR CRASH PREVENTION: AWARENESS STRATEGIES IN SCHOOLS, WORKPLACES, AND COMMUNITIES

Joscelito Novais da Cruz¹

Abstract: Road traffic crashes remain among the leading causes of premature death in Brazil and worldwide, disproportionately affecting children, adolescents, and young adults. Given the structural limitations of policies that rely exclusively on enforcement and penalties, traffic safety education has been identified by the international literature and by Brazilian regulatory frameworks as an essential, permanent pillar of road safety, alongside engineering and enforcement. This article aims to synthesize the scientific evidence produced between 2021 and 2026 on traffic safety awareness strategies targeting schools, workplaces, and communities, identifying the state of the art regarding the effectiveness of different educational methods. A systematic literature review was conducted in the Scopus, Web of Science, PubMed/MEDLINE, SciELO, and Google Scholar databases, supplemented by technical and regulatory documents from Brazilian traffic authorities, following steps informed by the PRISMA guidelines. The results show that traffic safety education programs for children and adolescents produce consistent gains in knowledge, attitudes, and safe behavior, particularly when they combine audiovisual resources, simulation, and virtual reality with interactive methods and peer involvement; that stand-alone mass media campaigns have modest, short-lived effects, becoming more robust when combined with enforcement and formal education; and that collaboration among government agencies, schools, businesses, and highway concessionaires expands the reach, sustainability, and credibility of educational initiatives, as illustrated by Brazilian experiences tied to the National Traffic Week and the Federal Highway Police's Highway Cinema. The article

¹ The author gives lectures and leads traffic safety education initiatives, including participation in the National Traffic Week in Chapecó, Santa Catarina (SC), Brazil, and outreach for the Federal Highway Police (PRF) Highway Cinema Truck, an initiative run in partnership with the highway concessionaire Arteris.



concludes that the effectiveness of traffic safety education as a permanent prevention policy depends on continuity across the life course, systematic outcome evaluation, and cross-sector governance with clear indicators — elements that remain underdeveloped in Brazilian national policy, as recent audits of the National Plan for the Reduction of Traffic Deaths and Injuries (Pnatrans) have pointed out.

Keywords: Traffic safety education. Road safety. Crash prevention. Road safety policy. Systematic literature review.

INTRODUCTION

For decades, road traffic crashes have been one of the most persistent public health and safety problems worldwide. According to the World Health Organization's (WHO) Global Status Report on Road Safety 2023, approximately 1.19 million people die each year as a result of road traffic crashes, which remain the leading cause of death among children and young people aged 5 to 29 worldwide, with more than half of all fatalities occurring among pedestrians, cyclists, and motorcyclists, especially in low- and middle-income countries (WORLD HEALTH ORGANIZATION, 2023). The same report notes that, among the most populous countries monitored during the 2010–2021 Decade of Action, Brazil was one of those that achieved a substantial reduction in the absolute number of traffic deaths, which signals progress in national public policy, even though mortality levels remain unacceptably high (WORLD HEALTH ORGANIZATION, 2023).

In Brazil, the most recent data from the Federal Highway Police (PRF) show that, on federal highways alone, 2024 ended with 73,156 crashes, 6,160 deaths, and 84,526 injuries; in 2025, the figures were 72,483 crashes and 6,044 deaths — a modest decline, but one that still amounts to an average of roughly 16 deaths per day on the federal highway network (POLÍCIA RODOVIÁRIA FEDERAL, 2025). When all of the country's roads are taken into account, the Ministry of Health recorded more than 26,000 traffic deaths in 2024, placing road traffic among the leading external causes of death in Brazil. These numbers become even



more alarming in light of widely cited estimates from organizations involved in professional driver training, according to which approximately 90% of traffic crashes in the country are directly or indirectly related to human error — rather than to purely mechanical or road-engineering failures (SEST SENAT, 2025).

It is precisely the central role of the human factor that gives traffic safety education a strategic place in the architecture of road safety policy. Historically, the institutional response to traffic crashes has favored enforcement and penalties as the primary tools for controlling behavior. However, the specialized literature has shown, with increasing consistency, that enforcement alone has limited and intermittent effects when it is not accompanied by educational initiatives capable of shaping the knowledge, attitudes, and values of the different road users — drivers, passengers, pedestrians, cyclists, and motorcyclists (GOEL et al., 2024; AKBARI et al., 2024). In Brazil, this understanding is written into the law itself: the Brazilian Traffic Code (CTB), established by Law No. 9,503 of September 23, 1997, assigns joint responsibility for crash prevention to five areas of government — health, education, labor, transportation, and justice — and requires that traffic safety education be promoted on a permanent, coordinated basis among the agencies of the National Traffic System (BRASIL, 1997).

This legal mandate was reinforced in 2018 by the creation of the National Plan for the Reduction of Traffic Deaths and Injuries (Pnatrans), established by Law No. 13,614/2018, which set the goal of cutting the per capita traffic death rate by at least half by 2030, in line with the United Nations Decade of Action for Road Safety (BRASIL, 2018). In its 2023 revision, Pnatrans explicitly adopted the Safe System approach, recognizing that traffic safety education initiatives deliver meaningful results in the short and medium term, in contrast to structural measures whose effects tend to take longer to materialize — which underscores the immediate relevance of investing in awareness (BRASIL, 2023).

This is the context for the hands-on experience that motivates this article. The author's work delivering traffic safety lectures, his participation in the National Traffic Week held in Chapecó (SC) — an annual event that brings together business associations, schools, driving schools, the Municipal Guard, and law enforcement agencies around awareness



activities — and his collaboration in promoting the Federal Highway Police's Highway Cinema Truck, an educational initiative carried out in partnership with the concessionaire Arteris, illustrate in everyday practice the kind of coordination among government, schools, businesses, and communities that the scientific literature identifies as decisive for the effectiveness of traffic safety education. This experience, however, has yet to be systematically examined in light of the most recent research on the subject — a gap this article seeks to fill.

METHODOLOGY

This study is a systematic literature review, with steps informed by the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which are widely used in road safety reviews (FAUS et al., 2021; NAWAZ et al., 2026). A thematic narrative synthesis was chosen over a statistical meta-analysis because of the high heterogeneity in study designs, target populations, measured outcomes, and socioeconomic contexts found in research on traffic safety education — a heterogeneity that previous reviews have already identified as a structural limitation of this field (GOEL et al., 2024; NAWAZ et al., 2026).

The literature search was conducted in the Scopus, Web of Science, PubMed/MEDLINE, SciELO, and Google Scholar databases, supplemented by a search of institutional repositories of Brazilian traffic authorities — the Ministry of Transportation, the National Traffic Secretariat (Senatran), the Federal Highway Police, the State Departments of Motor Vehicles (Detrans), and the Federal Court of Accounts (TCU) — in order to incorporate official data and regulatory documents that situate the international academic literature within the Brazilian context. The search terms, in Portuguese, English, and Spanish, combined “educação para o trânsito,” “segurança viária,” “traffic safety education,” “road safety education,” “road safety campaign,” “driver training,” “pedestrian safety,” “school-based intervention,” and “community-based intervention,” linked by Boolean operators to the terms “effectiveness,” “systematic review,” “evaluation,” “school,”



“children,” “workplace,” and “community.”

The inclusion criteria were: (a) empirical studies, systematic reviews, meta-analyses, or evidence maps published between 2021 and 2026; (b) publications in Portuguese, English, or Spanish; (c) studies focusing on educational interventions, communication campaigns, or awareness strategies related to road safety, delivered to children, adolescents, adults, professional drivers, or communities; and (d) official Brazilian documents on traffic safety education policy, regardless of publication date, in the case of regulatory frameworks still in force (such as the Brazilian Traffic Code) or the most recent official statistics available. Studies focusing exclusively on road engineering, infrastructure design, or vehicle technology with no educational or communication component were excluded, as were conference abstracts, editorials, and studies without full-text access.

The selection process followed three stages: screening of titles and abstracts to exclude studies clearly outside the scope; full-text review of the pre-selected studies to verify eligibility criteria; and thematic extraction of findings, organized according to the seven themes that structure the Results and Discussion section of this article. For each theme, extraction prioritized the studies with the most robust design available (systematic reviews and randomized controlled trials, where they existed), supplemented by observational studies and institutional documents when experimental evidence was scarce — a recurring situation in the evaluation of traffic safety communication campaigns, as previously noted by Faus et al. (2021).

As methodological limitations, it is acknowledged that the absence of a pre-registered protocol (e.g., in PROSPERO) and the fact that the review was conducted by a single author may introduce selection bias, although this was mitigated by the use of explicit inclusion and exclusion criteria. Possible publication bias is also acknowledged, since studies with positive results tend to be published more often than studies with null or negative findings — a bias already discussed in the literature on traffic campaign evaluation (FAUS et al., 2021). Finally, the narrative nature of the synthesis precludes the calculation of pooled effect sizes; a qualitative, comparative analysis of the findings was adopted instead.



RESULTS AND DISCUSSION

The analysis of the selected literature made it possible to organize the findings into seven themes, corresponding to the specific objectives of this article: traffic safety education as a permanent preventive measure; building safe behaviors from childhood; communication strategies for different audiences; the use of audiovisual resources in educational initiatives; collaboration among public agencies, schools, businesses, and concessionaires; evaluation of awareness campaign outcomes; and proposals for improving educational policy.

TRAFFIC SAFETY EDUCATION AS A PERMANENT PREVENTIVE MEASURE

The evidence and gap map developed by Goel et al. (2024) for the Campbell Collaboration, which brings together systematic reviews and impact evaluations of road safety interventions worldwide, places road user education, alongside enforcement, among the main human factors that public policy can address, noting that road traffic crashes account for 1.35 million deaths per year, about 93% of which occur in low- and middle-income countries. Similarly, the systematic review by Akbari et al. (2024), which analyzed road traffic injury prevention interventions in countries at different income levels, reinforces that combined strategies — involving enforcement, engineering, and education — outperform stand-alone interventions of any kind.

This conclusion is supported by the review by Faus et al. (2021) of road safety communication campaigns, which found that the impact of any preventive measure — whether an advertising campaign or an enforcement action — is substantially greater when paired with traffic safety education programs than when implemented on its own. This finding speaks directly to Brazil's institutional design: since 1997, the Brazilian Traffic Code has established shared responsibility among multiple areas of government for crash prevention (BRASIL, 1997), and the 2023 revision of Pnatrans reaffirms that traffic safety education initiatives produce meaningful results more quickly than structural road-engineering interventions, while maintaining that the two must work hand in hand (BRASIL, 2023).



The central role of the human factor in traffic crashes — estimated, in the Brazilian context, at around 90% of cases (SEST SENAT, 2025) — strengthens the argument that a sustained reduction in crashes cannot rely solely on sanctions. Enforcement acts primarily on the immediate behavior of individuals whose habits are already formed, whereas traffic safety education shapes values, knowledge, and behavioral dispositions over the medium and long term, with the potential to reach audiences not yet licensed to drive, such as children and adolescents (NAWAZ et al., 2026). These are, therefore, complementary rather than substitute tools, and their combination is the strategy most strongly supported by the international literature.

BUILDING SAFE BEHAVIORS FROM CHILDHOOD

The most comprehensive systematic review on traffic safety education for children and adolescents identified in this research is that of Nawaz et al. (2026), published in *Transportation Research Part F: Traffic Psychology and Behaviour*, which synthesized 46 studies published between 2004 and 2024, following the PRISMA guidelines and searching the Scopus, PubMed, and Web of Science databases. The authors found that 83% of the studies reported significant improvements in road safety knowledge, 71% showed positive changes in attitudes, and 68% recorded measurable behavioral improvements, such as safer street-crossing and cycling behaviors. The study further highlights that technology-based approaches — gamified platforms, virtual reality simulations, and community-based initiatives — performed particularly well in terms of participant engagement, risk perception, and decision-making (NAWAZ et al., 2026).

This finding is supported by a robust body of randomized controlled trials on the use of virtual reality to build safe pedestrian behaviors in children. The meta-analysis by Morgan, Stager, and Schwebel (2023), published in the *Journal of Pediatric Psychology*, assessed the efficacy of virtual reality interventions for teaching children to cross streets safely, concluding that such interventions produce consistent gains in crossing skills compared with control groups. Along similar lines, the randomized trial by Morrongiello et al. (2024) on the “Safe



Peds” program — virtual reality training for children aged 7 to 10 — showed significant improvements in stopping and checking for traffic, as well as in selecting safer gaps between vehicles before crossing, although the authors point to the need for additional training on the right moment to start crossing once a safe gap has been chosen.

In the school setting, the study by von Beesten and Bresges (2022), published in *Frontiers in Psychology*, evaluated a traffic crash prevention program delivered in schools in North Rhine-Westphalia, Germany, as part of the “Crash Kurs NRW” program, which exposes students to a wrecked vehicle and uses role-playing to discuss risky traffic scenarios. The authors found that highly emotional campaigns, when not followed by ongoing educational work, can trigger psychological reactance — that is, rejection of the message and, in some cases, the so-called “boomerang effect,” in which the target audience responds in the opposite way to what the campaign intended. In a follow-up study, von Beesten, Bresges, and Lubert (2023) developed and tested a post-campaign educational follow-up protocol, concluding that combining emotional appeals with interventions focused on problem-solving, concrete action, and strengthening students' self-esteem is essential to mitigate the boomerang effect and consolidate safe, lasting behaviors.

Studies focusing specifically on pedestrian safety reinforce this picture. The systematic review by Namatovu et al. (2022), published in *PLOS ONE*, analyzed randomized controlled trials, interrupted time-series studies, and controlled before-after studies aimed at reducing pedestrian crashes, finding that combined interventions — integrating changes to the road environment with education and enforcement — produce the most consistent effects on pedestrian safety, particularly around schools. Likewise, the review by Rezapur-Shahkolai et al. (2022), published in the *International Journal of Injury Control and Safety Promotion*, concluded that educational interventions targeting pedestrians have positive effects on knowledge and behavior, especially when grounded in behavioral theory and tailored to the age group of the target audience.

Finally, it is worth highlighting the relevance of peer education as a low-cost strategy with high potential for dissemination. The study by Masilamani et al. (2022), conducted in India and published in the *Indian Journal of Community Medicine*, evaluated a traffic safety



education program delivered by trained adolescents to their peers, finding a statistically significant increase in road safety knowledge after the intervention. Taken together, these findings support the premise that building safe behaviors from childhood should combine theoretical content, hands-on practice — whether in person or through immersive technologies — and active student leadership, as opposed to purely lecture-based models.

COMMUNICATION STRATEGIES FOR DIFFERENT AUDIENCES

The systematic review by Faus et al. (2021), published in the journal *Safety*, remains one of the broadest analyses to date of the effectiveness of road safety communication campaigns. After screening 613 articles indexed in Web of Science, Scopus, NCBI, Google Scholar, and APA databases, the authors selected 27 studies that formally evaluated the outcomes of traffic safety advertising campaigns published between 1990 and 2020 — a surprisingly small number given the scale of financial, material, and human resources historically invested in such initiatives worldwide. The authors found that stand-alone advertisements have a positive but limited effect, and that this effect increases substantially when campaigns are accompanied by other preventive measures, such as stricter legislation or formal traffic safety education programs (FAUS et al., 2021).

One of the most relevant findings of this review for designing communication strategies is that a campaign's effectiveness depends not only on the content of the message but also on matching the channel and tone to the specific target audience — which requires tailoring the communication strategy and resources to the profile of the audience being reached at any given time (FAUS et al., 2021). This principle of audience segmentation is reinforced by the studies of von Beesten and colleagues (2022; 2023), discussed in the previous section, which show that the same emotional appeal can produce different effects — acceptance or reactance — depending on age group, institutional context (for example, the presence or absence of police officers during the activity), and whether a structured educational follow-up takes place after exposure to the message.

In Brazil, this logic of audience segmentation can be seen in the programming of the



National Traffic Week, held every year from September 18 to 25 as mandated by the Brazilian Traffic Code (BRASIL, 1997). Reports on recent editions of the event in various Brazilian municipalities show communication strategies clearly differentiated by audience: playful approaches and the use of children as protagonists in advertising aimed at the general public, as reported by the Santa Catarina State Department of Motor Vehicles (Detran/SC) in campaigns themed “No trânsito, escolha a vida” (“On the road, choose life”); hands-on simulations with impairment (“drunk”) goggles and mock traffic courses aimed at students and young people, as seen in activities organized by business associations in Chapecó (SC); and targeted messages for motorcyclists, cyclists, and delivery workers, groups identified as the most vulnerable in urban crash statistics. This diversification of language and format by audience segment is consistent with the international literature's recommendation that effective campaigns avoid generic messages and prioritize alignment with the behavioral profile of each group of road users (FAUS et al., 2021).

USE OF AUDIOVISUAL RESOURCES IN EDUCATIONAL INITIATIVES

Audiovisual resources play a prominent role in the traffic safety education literature, both in their more traditional form — videos, dramatizations, and displays of wrecked vehicles — and in their newer technological form, with the use of driving simulators and virtual reality environments. The systematic review by Alonso et al. (2023), published in *Applied Sciences*, assessed 17 empirical studies on the effectiveness of driving simulators as a driver training tool, concluding that simulators make relevant contributions to road safety by allowing skills to be trained in controlled-risk environments, although important limitations remain regarding the sample sizes of available studies and the long-term follow-up of outcomes.

In the specific field of children's education, the previously mentioned studies by Morgan, Stager, and Schwebel (2023) and Morrongiello et al. (2024) reinforce the effectiveness of virtual reality environments for safely rehearsing street-crossing behaviors, allowing children to practice risky decisions — such as when to cross in the face of oncoming



traffic — without exposure to real danger, an outcome that purely lecture-based methods can hardly replicate.

With regard to more traditional audiovisual resources, the Brazilian experience of the Federal Highway Police's (PRF) Highway Cinema offers a concrete illustration of the principles discussed in the international literature. It is a mobile movie theater — installed in a semi-trailer that seats dozens of people per screening — in which officers from the Traffic Safety Education Group (Getran) show short videos depicting real crashes caused by disregard for traffic laws, followed by a structured discussion with the audience, linking the audiovisual content to collective reflection on each road user's role in road safety (POLÍCIA RODOVIÁRIA FEDERAL, 2025). The initiative is often carried out in partnership with highway concessionaires, state Departments of Motor Vehicles (Detrans), and transportation industry unions, and it is part of, for example, the national Yellow May (Maio Amarelo) campaign, during which Arteris, one of the country's leading highway operators, combines the screening of educational videos with messages on electronic signs and social media, under the theme of valuing life on the road (ARTERIS, 2026).

This model — which combines audiovisual screening, in-person outreach, and structured discussion — aligns with the central finding of the review by Faus et al. (2021) that stand-alone audiovisual materials have a more limited effect than when they are paired with a moment of educational or institutional facilitation. Likewise, the display of a wrecked vehicle as a teaching tool, as described by von Beesten and Bresges (2022) in the German context, bears a structural resemblance to Brazilian practices of displaying police vehicles, enforcement equipment, and crash simulators at events such as the National Traffic Week, supporting the hypothesis that concrete audiovisual and sensory resources, when accompanied by qualified human facilitation, tend to produce greater learning retention than media-only campaigns.



COLLABORATION AMONG PUBLIC AGENCIES, SCHOOLS, BUSINESSES, AND CONCESSIONAIRES

The literature converges on the diagnosis that institutional fragmentation is one of the main obstacles to the effectiveness of traffic safety education. The very design of Pnatrans acknowledges this need by requiring the plan to be developed jointly by the health, traffic, transportation, and justice agencies (BRASIL, 2018), replicating at the federal level the multisector shared-responsibility logic already set forth in the Brazilian Traffic Code since 1997 (BRASIL, 1997). In practice, this collaboration takes the form of arrangements that bring public, private, and community actors together around shared calendars and initiatives, such as the aforementioned National Traffic Week.

The experience of the municipality of Chapecó (SC) illustrates this multisector collaboration model. According to reports from local business organizations, the city's National Traffic Week brings together, under the coordination of the municipal government, groups of private schools, driving schools (driver training centers), gyms, and auto repair shops affiliated with the local business association, as well as the Municipal Guard and the Civil Police, in activities that include a mock traffic course, the use of impairment goggles, and initiatives aimed at vulnerable groups such as motorcyclists, cyclists, older adults, and people with disabilities. The program also includes educational activities for approximately 900 children from the municipal school system, who take part in fun, interactive talks and engage with law enforcement officers. This model brings together precisely the three audiences within the scope of this article — schools, businesses, and the community — under the coordination of the municipal government, consistent with what the literature identifies as the most promising arrangement for the sustainability of educational initiatives.

At the federal level, the work of the Federal Highway Police exemplifies collaboration between public agencies and the private sector. In addition to the Highway Cinema, the PRF runs the Student Traffic Theme Festival (Fetran) and the EducarPRF project, both aimed at children and teenagers and carried out in partnership with school systems, in which teachers are trained to integrate traffic safety across the school curriculum,



culminating in artistic and educational projects produced by the students themselves (POLÍCIA RODOVIÁRIA FEDERAL, 2025). At the same time, highway concessionaires such as Arteris maintain their own road safety programs — such as the “Programa Viva” (Viva Program) — which complement PRF initiatives during campaigns such as Yellow May, delivering dozens of joint educational activities throughout the year aimed at drivers, pedestrians, and communities along the concession highways (ARTERIS, 2026).

With specific regard to the business sector, the role of the Transportation Social Service and National Transportation Training Service (Sest Senat) deserves special mention. Sest Senat is a professional training system funded by the freight and passenger transportation industry, with a presence in more than 5,300 Brazilian municipalities. In 2024, Sest Senat recorded more than 17.6 million services delivered, of which approximately 8.1 million were related to professional driver training, including defensive driving courses, heavy-vehicle driving simulators, and awareness programs designed specifically for professional drivers (SEST SENAT, 2025). Company-specific initiatives in the logistics sector — such as periodic training on defensive driving, working hours, and the use of in-vehicle technologies — complement this institutional effort, showing that collaboration between government and businesses in traffic safety education is not limited to one-off campaigns but can take the form of permanent professional development systems.

This set of institutional arrangements is precisely what the author's own hands-on experience — through his traffic safety lectures, his participation in the National Traffic Week in Chapecó (SC), and his collaboration in promoting the PRF Highway Cinema Truck in partnership with Arteris — illustrates at the local level, confirming in everyday practice the literature's findings on the importance of cross-sector coordination for the effectiveness of traffic safety education.

EVALUATING THE OUTCOMES OF AWARENESS CAMPAIGNS

One of the most relevant — and most concerning — findings of this review concerns the scarcity of formal evaluations of traffic safety awareness campaign outcomes. As noted



above, Faus et al. (2021) identified only 27 studies that formally evaluated road safety communication campaigns over three decades of international research, a disproportionately small number given the scale of resources invested globally in this type of initiative. The authors themselves point out that this gap makes it difficult to determine which communication techniques are actually effective and which should be replaced by new behavior-change methods (FAUS et al., 2021).

The evidence and gap map by Goel et al. (2024) reinforces this diagnosis by identifying, on a global scale, an uneven distribution of evidence across intervention categories: while road-engineering measures and legislative changes have a relatively larger body of impact evaluations on fatal and non-fatal crashes, education and communication interventions — especially those aimed at specific audiences such as workers and communities — remain comparatively under-evaluated, creating evidence gaps that limit data-driven decision-making.

At the national level, the gap between institutional educational efforts and the measurement of their population-level outcomes becomes evident when crash indicators are compared with Pnatrans's own governance indicators. Although PRF data show a modest decline in deaths on federal highways between 2024 and 2025 — from 6,160 to 6,044 — this improvement coexists with more than 26,000 traffic deaths nationwide in 2024, according to the Ministry of Health, a figure that has remained virtually flat for years and is still far from the goal of halving deaths by 2030 (BRASIL, 2023; POLÍCIA RODOVIÁRIA FEDERAL, 2025). This apparent stagnation prompted a 2025 audit of Pnatrans by the Federal Court of Accounts (TCU), which identified eight significant audit findings, including weaknesses in the operating structure of the plan's governance body (the Pnatrans Technical Chamber), weak institutional capacity at Senatran, flaws in the plan's design with respect to results orientation and prioritization of actions, and poor traceability and budget decentralization of the planned initiatives (TRIBUNAL DE CONTAS DA UNIÃO, 2025).

Taken together, these findings suggest that the central limitation of traffic safety education policy in Brazil lies not in a lack of initiatives — as demonstrated by the many programs run by the PRF, the Detrans, Sest Senat, and private concessionaires — but in weak



mechanisms for systematic outcome evaluation and budget governance that would make it possible to rigorously identify which actions have a measurable impact on reducing deaths and injuries, and to allocate resources more efficiently. This conclusion is fully consistent with the international literature's diagnosis regarding the scarcity of formal evaluation of traffic safety campaigns and educational programs (FAUS et al., 2021; GOEL et al., 2024).

PROPOSALS FOR IMPROVING EDUCATIONAL POLICY

Based on the synthesis of the preceding findings, it is possible to put forward a set of proposals for improving traffic safety education policy in Brazil, grounded in the international evidence reviewed. First, it is recommended that the Safe System approach already incorporated into the 2023 revision of Pnatrans be strengthened; this approach recognizes the shared responsibility of road system designers and road users and positions traffic safety education as one of several layers of protection, rather than as a stand-alone measure sufficient in itself (BRASIL, 2023).

Second, the findings on children's education suggest expanding the use of technology-based methods — gamification, simulators, and virtual reality — in initiatives aimed at children and adolescents, given the superior performance of these approaches in engagement and in the retention of safe behaviors, as demonstrated by Nawaz et al. (2026) and by the studies of Morgan, Stager, and Schwebel (2023) and Morrongiello et al. (2024). These technologies can be incorporated into existing programs such as Fetran and EducarPRF without displacing traditional in-person methods, which remain relevant, especially in municipalities with limited technological infrastructure.

Third, building safe behaviors should be conceived as a continuous process throughout the life course, rather than as a one-time intervention limited to childhood or to obtaining a first driver's license. This means ensuring institutional continuity for programs aimed at adolescents (peer education, as in Masilamani et al., 2022), new drivers (driving simulators, as in Alonso et al., 2023), and professional drivers (ongoing training, such as that offered by Sest Senat), linking these learning stages into a coherent pathway instead of



treating them as isolated, disconnected initiatives.

Fourth, communication strategies for different audiences should be designed through deliberate segmentation of language, channel, and emotional appeal, avoiding generic, one-size-fits-all messages. The literature specifically recommends caution in the use of strong emotional appeals without structured educational follow-up, given the risk of triggering reactance and the boomerang effect, particularly among young audiences (VON BEESTEN; BRESGES, 2022; VON BEESTEN; BRESGES; LUBERT, 2023). Campaigns such as the National Traffic Week already demonstrate, in Brazilian practice, the ability to tailor language to different audiences (children, motorcyclists, professional drivers), and this should be formalized as an explicit communication-planning guideline at every level of government.

Fifth, and perhaps most urgently, it is recommended that mandatory outcome evaluation protocols be established for every publicly funded traffic safety education initiative, including process indicators (number of people reached, participation), outcome indicators (changes in knowledge and attitudes, measured with standardized pre- and post-intervention instruments), and, where feasible, impact indicators (changes in crash indicators within the target population). This recommendation responds directly both to the international gap identified by Faus et al. (2021) and Goel et al. (2024) and to the weaknesses in governance and results orientation identified by the TCU in its 2025 audit of Pnatrans (TRIBUNAL DE CONTAS DA UNIÃO, 2025).

Finally, it is recommended that cross-sector governance arrangements be formalized and expanded along the lines already seen in municipal and regional experiences — such as the National Traffic Week in Chapecó (SC) and the joint work of the PRF, the Detrans, and concessionaires such as Arteris — with clearly defined roles, shared indicators, and budget traceability, so that initiatives that currently depend on the individual leadership of public servants, volunteers, and private partners can achieve institutional continuity regardless of changes in administration.



CONCLUSION

Based on scientific evidence produced between 2021 and 2026, this systematic literature review confirmed the central hypothesis of this article: a sustained reduction in traffic crashes does not depend solely on enforcement and penalties but is inseparable from the ongoing education of drivers, passengers, pedestrians, and all other road users. The findings reviewed show that traffic safety education programs for children and adolescents produce consistent gains in knowledge, attitudes, and behavior, particularly when they combine interactive methods, audiovisual resources, and immersive technologies such as virtual reality; that stand-alone communication campaigns have modest, short-lived effects, becoming more robust when paired with enforcement and formal education; and that collaboration among government, schools, businesses, and highway concessionaires — as seen in Brazilian experiences tied to the National Traffic Week and the Federal Highway Police's Highway Cinema — expands the reach and credibility of educational initiatives.

At the same time, the review revealed a structural gap common to both the international literature and the Brazilian context: the scarcity of formal, systematic evaluations of the outcomes of traffic safety campaigns and educational programs, compounded in Brazil by governance and results-orientation weaknesses recently identified in the audit of the National Plan for the Reduction of Traffic Deaths and Injuries. This gap limits the ability of public and private decision-makers to pinpoint which strategies have a measurable impact on reducing deaths and injuries, and to allocate already scarce resources more efficiently.

The hands-on experience that motivated this article — the author's traffic safety lectures, his participation in the National Traffic Week held in Chapecó (SC), and his work promoting the PRF Highway Cinema Truck in partnership with the concessionaire Arteris — illustrates, at the local level, both the potential and the limits of this kind of multisector collaboration. By systematically examining this experience in light of the most recent scientific literature, this article seeks to provide technical and social support for public officials as well as for businesses and concessionaires interested in improving their own



awareness strategies, contributing to a more firmly established road safety culture in Brazil.

As a future research agenda, Brazilian studies with experimental or quasi-experimental designs are recommended to rigorously assess the impact of specific programs such as Fetrans, EducarPRF, and the Highway Cinema on indicators of knowledge, attitudes, and, where possible, crash rates, in order to generate national evidence comparable to that already available in other countries and to inform data-driven public policy decisions.

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