

Assessing Teaching Methods to Improve Traffic Education in Ghanaian Pre-Tertiary Schools

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ABSTRACT

Road traffic accidents are a leading cause of death among young people in Ghana, emphasizing the urgent need for effective traffic education in pre-tertiary schools. This study evaluates the pedagogical strategies employed in teaching traffic education in the Kumasi Metropolis, focusing on the perceptions and experiences of educators and identifying key barriers to implementation. Utilizing a convergent parallel mixed-methods design, data were collected from 114 teachers through surveys combining quantitative and qualitative approaches. The results indicate that traditional lecture-based instruction, although frequently used, is perceived as the least effective in engaging students. In contrast, interactive methods such as role-playing, multimedia presentations, and field trips, though less frequently employed, were rated as significantly more effective in fostering student understanding and engagement. However, challenges such as inadequate resources, curriculum gaps, and limited teacher training hinder effective implementation. The study calls for targeted interventions, including curriculum integration and enhanced teacher support, to optimize traffic education in Ghanaian schools.

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Introduction

Transportation is an essential part of modern life, serving as a backbone for economic growth, education, healthcare, and social interactions. The ability to move people and goods efficiently not only fuels economic activities but also connects communities, enhancing the overall quality of life [1]. However, the significant expansion of road networks over the past decades has brought serious challenges, particularly road traffic accidents, which have emerged as a major public health concern worldwide [2] [3].

Globally, road traffic accidents claim approximately 1.19 million lives each year, with an additional 20 to 50 million people suffering non-fatal injuries, many of which result in long-term disabilities [4]. These incidents do not just bring personal tragedy; they also impose substantial economic costs, including medical expenses, loss of productivity, and the long-term care of those who survive with disabilities. For many countries, these costs amount to about 3% of their gross domestic product, severely straining healthcare systems and economic growth. The burden of these accidents is most pronounced in low- and middle-income countries, particularly in Africa, where road traffic injuries are the leading cause of death among children and young adults aged 5 to 29 years [4].

Ghana mirrors this global trend, with road traffic injuries and fatalities posing significant challenges to public health and safety. Each year, approximately 72 people per 100,000 are injured in road accidents, with close to 8 fatalities per 100,000 population, disproportionately affecting individuals under 35 years old [5]. Despite concerted efforts by the government and various stakeholders to promote road safety, accidents remain prevalent, particularly among school-aged children who are often pedestrians or cyclists on their way to and from school. Recognizing the critical role of education in shaping safe road behaviors, Ghana is integrating traffic education into its pre-tertiary curriculum as a preventive measure to reduce these alarming statistics [6].

The success of traffic education hinges on the effectiveness of the pedagogical strategies employed in the classroom. Pedagogical strategies (the methods and techniques teachers use to deliver content) play a crucial role in shaping how students learn and apply knowledge [7]. These strategies range from traditional lecture-based approaches, which focus on direct instruction from teacher to student, to more innovative, interactive methods that actively engage learners. The choice of strategy is influenced by the subject matter, the educational context, and the diverse needs of students [8].

Lecture-based instruction has long been a staple in classrooms around the world. Its structured approach allows teachers to cover large amounts of content efficiently. However, while lectures are practical, especially in resource-constrained environments, they are often

criticized for their passive nature, which can fail to engage students and limit opportunities for hands-on learning [9] [10]. In contrast, interactive methods such as role-playing and group discussions offer more engaging way of teaching. Role-playing allows students to immerse themselves in real-life scenarios [11]. This experiential learning approach not only makes learning more enjoyable but also helps students develop critical thinking and decision-making skills [12]. Similarly, group discussions encourage dialogue and the exchange of ideas, fostering a deeper understanding of concepts through collaborative learning [13] [14].

The integration of technology in education has further expanded the possibilities for engaging students in their learning. Interactive multimedia presentations, which combine videos, animations, and interactive elements, have proven effective in enhancing student comprehension by making abstract concepts more tangible [15]. These technologies bring road safety lessons to life, offering visual and interactive experiences that traditional methods often lack. Additionally, field trips provide valuable opportunities for students to observe and practice safe road behaviors in real-world settings, reinforcing classroom learning with practical, hands-on experiences [16]. These approaches cater to diverse learning styles and help develop critical thinking and problem-solving skills [17].

However, existing studies on traffic education in sub-Saharan Africa often focus on policy implementation rather than the effectiveness of pedagogical approaches, leaving a significant research gap [3]. Even when teaching methods are explored, many studies rely on self-reported data, which may not fully capture the complex challenges teachers face in classroom implementation [18]. Empirical evidence comparing the effectiveness of different teaching strategies in traffic education is limited, especially in junior and senior high school contexts where traffic education is less structured and more sporadic [6]. There is a pressing need for research that systematically evaluates these pedagogical strategies to identify which methods best equip young learners with essential road safety skills.

The study addresses this gap by evaluating the pedagogical strategies used in traffic education at the pre-tertiary level in Ghana. Through a mixed-methods approach, the study explores teachers' perceptions, the effectiveness of various teaching strategies, and the challenges encountered in implementing traffic education programs. The findings aim to provide actionable insights that inform curriculum development, teacher training, and policy initiatives, ultimately enhancing the delivery of traffic education in Ghanaian schools. This will also contribute to the broader discourse on improving road safety education and support the development of targeted interventions to foster safer road behaviors among young people.

Methodology

This study employed a convergent parallel mixed-methods design to evaluate the pedagogical strategies used in traffic education at the pre-tertiary level. The mixedmethods

approach allowed for the integration of both quantitative and qualitative data, providing a detailed understanding of the current practices, perceptions, and challenges associated with traffic education. This design was selected to capture the complexity of the educational environment, ensuring that quantitative findings were complemented and enriched by qualitative perspectives, which is crucial in addressing the diverse research objectives.

The study targeted teachers from pre-tertiary schools, including primary, junior high, and senior high schools within the Kumasi Metropolis - one of the largest urban areas in Ghana. Kumasi was chosen due to its diverse educational landscape, which provides a representative sample of the various challenges faced in urban school settings across the country [19]. The inclusion of teachers directly involved in delivering traffic education was intended to capture first-hand experiences and evaluate the effectiveness of pedagogical strategies based on practical implementation.

A stratified random sampling technique was used to ensure proportional representation from each school level, allowing the study to capture variations in teaching strategies across different educational stages. The sample size was determined using the Krejcie and Morgan formula, which provides guidelines for sample size determination in survey research [20]. The calculated sample size of 241 was adjusted for response rates, resulting in 114 valid responses. This response rate aligns with established norms in educational research and provides a robust dataset for analysis [21]. The survey was distributed through widely used social media platforms such as WhatsApp and Telegram to ensure broad reach among teachers in the region.

The survey instrument was designed based on established literature and expert input, with sections covering demographic information, frequency of use of teaching strategies, perceived effectiveness, and challenges faced in implementing traffic education. Closed-ended questions facilitated quantitative analysis, while open-ended questions allowed for the collection of rich qualitative data, capturing teachers' knowledge and experiences in their own words.

Quantitative data were analyzed using descriptive and inferential statistics to assess the effectiveness of various pedagogical strategies. Descriptive statistics summarized the demographic characteristics of the sample, the frequency of different teaching methods, and overall teacher satisfaction levels. To compare the effectiveness of the strategies, an Analysis of Variance (ANOVA) was conducted, followed by Tukey's Honest Significant Difference (HSD) post-hoc tests to identify significant differences between teaching methods [22].

Qualitative data from the open-ended survey responses were analyzed using thematic content analysis, a systematic approach to identifying, coding, and categorizing key themes

within the data. This method enabled a deeper exploration of teachers' perceptions, revealing recurring patterns related to pedagogical challenges, resource constraints, and the practicalities of implementing interactive teaching methods. The integration of these qualitative acumens with quantitative findings enriched the analysis, providing a more holistic view of the effectiveness of traffic education strategies [23].

Participants were informed of the study's purpose and assured of the confidentiality and anonymity of their responses. Informed consent was obtained from all participants, and data were securely stored, with findings reported in aggregate form to prevent the identification of individual respondents.

Results and Analysis

The demographic profile of the respondents reveals a diverse and representative sample of educators involved in traffic education at the pre-tertiary level. A significant proportion of the participants were within the age ranges of 25-34 years (37.72%) and 35-44 years (27.19%), indicating that the majority of respondents were relatively young, active educators likely to be receptive to innovative pedagogical approaches. Smaller proportions were observed among those under 25 years (19.30%), 45-54 years (10.53%), and 55 years and above (5.26%), suggesting a less prominent engagement among older age groups.

The educational distribution highlights that the primary school level had the highest representation among the respondents (44.73%), followed by junior high school (29.82%), senior high school (22.81%), and vocational/technical schools (2.63%). This distribution emphasizes the prominence of traffic education at the foundational levels of the educational system, with primary schools being pivotal in implementing these educational interventions.

In terms of teaching experience, the respondents demonstrated substantial expertise, with 42.11% having 1-5 years of teaching experience, and 20.18% having 6-10 years of teaching experience. 3.51% and 34.2% had teaching experience below 1 year and over 10 years respectively. This experienced cohort is likely to possess advanced knowledge on the efficacy of various pedagogical strategies, reflecting a depth of professional knowledge that enhances the study's findings.

The study assessed respondents' awareness of the integration of traffic education into the pre-tertiary school curriculum. The results in Table 1 indicate that traffic education is not widely integrated across all school levels. A majority (50.87%) of respondents reported that traffic education is not part of their school curriculum, with the highest resistance observed in junior high schools (28.07%) and senior high schools (17.54%). Only 44.74% confirmed that traffic education is integrated into the curriculum, predominantly at the primary school level. This finding highlights a significant gap, particularly at the junior high and vocational/technical

school levels, suggesting a need for more structured incorporation of traffic education. This observation contrasts with the findings of Odame et al. [24], who reported a broader integration of traffic education in Ghana's pre-tertiary schools [24]. Moreover, integrating traffic education at the primary level aligns with international trends, where foundational education is emphasized as critical for developing early road safety awareness [25][26].

Table 1. School level and traffic education in the curriculum

School level	No (%)	Yes (%)	Maybe (%)
Primary School	2.63	40.35	1.75
Junior High School	28.07	0.0	1.75
Senior High School	17.54	4.39	0.88
Vocational/Technical School	2.63	0.0	0.0

Moreover, to understand the extent of traffic education implementation, respondents were asked how frequently they conducted traffic education lessons. The data (Table 2) revealed that the majority (55.26%) of respondents only taught traffic education occasionally, and weekly lessons were primarily found at the primary school level (30.7%). This pattern suggests that traffic education is more systematically embedded at the foundational level, with significantly lower prevalence in higher educational levels. Previous studies have explained the importance of regular exposure to traffic education to reinforce safety behaviors among students [17]. The irregular nature of instruction at higher levels, particularly in junior and vocational/technical schools, limits the effectiveness of traffic education initiatives.

Table 2. Frequency of teaching traffic education

School level	Daily (%)	Weekly (%)	Monthly (%)	Occasionally (%)
Primary	1.75	30.70	6.14	6.14
Junior High School	0.0	0.0	1.75	28.07
Senior High School	2.63	0.88	0.0	19.30
Vocational/Technical School	0.88	0.0	0.0	1.75

The study further examined the pedagogical strategies employed by teachers in delivering traffic education. The most frequently used method was lecture-based instruction (Table 3), reported by 69.9% of respondents. Role-play activities (54.00%) and field trips (48.7%) were also common but less frequently used. Group discussions were adopted by 22.1% of respondents, and interactive multimedia presentations by only 8.8%. Each respondent had the option to choose more than one strategy. The heavy reliance on lecture-based methods reflects a broader trend in educational settings where traditional approaches often dominate due to their ease of implementation and familiarity among educators [13].

Table 3. Pedagogical strategies used for traffic education

Pedagogical Strategies	Frequency	Percentage
Lecture-based instruction	79	69.9%
Role play activities	61	54.0%
Field trips to observe traffic	55	48.7%
Group discussions	25	22.1%
Interactive multimedia presentations	10	8.8%
Other	2	1.8%

However, evidence suggests that interactive and student-centred approaches, such as role-plays and multimedia presentations, are more effective in enhancing engagement and comprehension among learners [8][11]. This indicates a potential area for development, emphasizing the need to diversify teaching strategies to improve the quality of traffic education.

An ANOVA test was conducted to evaluate whether significant differences exist in the effectiveness ratings of various pedagogical strategies for traffic education. As shown in Table 4, the results indicate that the p-value (0.00085) is less than the conventional significance level ($p < 0.05$), leading to the rejection of the null hypothesis. This suggests that there are statistically significant differences in the effectiveness of the pedagogical strategies used in traffic education. The implication of these findings is that some strategies are notably more effective than others in enhancing students' understanding and retention of traffic safety knowledge. Identifying and prioritizing the most effective strategies could play a crucial role in improving traffic education outcomes, as different teaching methods cater differently to student engagement and learning styles.

Table 4. Effectiveness of different pedagogical strategies

Source	Sum of Squares	Df	F-value	P-value
Pedagogical Strategy	18.31	23	2.56	0.00085
Residual	27.97	90		

Following the ANOVA, Tukey's HSD test was employed to identify specific differences between the effectiveness of individual teaching methods. The results, displayed in Table 5, provide pairwise comparisons of the pedagogical strategies. The analysis revealed that the mean effectiveness score for field trips was significantly lower than that of group discussions, indicating that group discussions are perceived as more effective. Similarly, interactive multimedia, and role-playing presentations were found to be significantly more effective than field trips. Further comparisons indicated that group discussions, and interactive multimedia presentations had a significantly higher effectiveness rating compared to lecture-based

instruction, underlining the efficacy of interactive and student-centred teaching methods. This further reinforcing the importance of incorporating dynamic, technology-enhanced approaches in traffic education.

Table 5. Tukey's HSD Test Results

Group 1	Group 2	Mean Diff	p-adj	Lower	Upper	Reject
Field trip	Group dis.	-1.025	0.001	-1.5302	-0.5198	True
Field trip	Interactive mul.	-0.875	0.001	-1.3802	-0.3698	True
Field trip	Lecture-based	-0.4	0.17	-0.9052	0.1052	False
Field trip	Roleplay	-1.025	0.001	-1.5302	-0.5198	True
Group dis.	Interactive mul.	0.15	0.9	-0.3552	0.6552	False
Group dis.	Lecture-based	0.625	0.001	0.1198	1.1302	True
Group dis.	Roleplay	0	1	-0.5052	0.5052	False
Interactive mul.	Lecture-based	0.475	0.004	-0.0302	0.9802	True
Interactive mul.	Roleplay	-0.15	0.9	-0.6552	0.3552	False
Lecture-based	Roleplay	-0.625	0.001	-1.1302	-0.1198	True

Conversely, no significant differences were observed between field trips and lecture-based instruction, suggesting similar levels of perceived effectiveness. The comparisons between group discussions and interactive multimedia presentations, as well as between multimedia and role-play activities, also showed no significant differences, indicating comparable efficacy among these methods. These findings highlight the variability in effectiveness across different teaching strategies, with a clear trend favoring interactive and experiential learning approaches over traditional, didactic methods. This aligns with broader educational research, which supports the integration of active learning techniques, such as group discussions and multimedia presentations, to enhance student engagement and retention of complex concepts [27, 28].

Recommendation

A. Implementation Challenges

In exploring the challenges teachers encounter when implementing pedagogical strategies for traffic education, qualitative feedback from 54 respondents revealed several recurring issues. The analysis identified five main challenges: curriculum and content issues, unavailability of resources, inadequate teacher preparedness and support, logistical and environmental constraints, and limited student motivation and engagement, particularly in non-examinable subjects.

Curriculum and content issues were highlighted as a significant challenge. Respondents noted that traffic education is often not formally included in the school curriculum, particularly at the high school level, making it difficult to structure and deliver lessons effectively. The

absence of formal integration leads to unplanned and unstructured teaching, with content often dependent on teachers' discretion.

Resource availability was another critical challenge identified by teachers. The lack of teaching materials, textbooks, and other instructional aids significantly hampers the delivery of effective traffic education. Many respondents expressed frustration over the scarcity of resources, which restricts both the depth and breadth of content that can be covered. This aligns with broader challenges faced in under-resourced educational settings, where material constraints often compromise teaching quality and hinder thorough lesson preparation.

Teachers also pointed to inadequate preparedness and support as a key obstacle. A lack of formal training on traffic education forces educators to rely on personal experience when teaching this subject. Furthermore, insufficient support from school authorities, the community, and government limits opportunities for practical learning activities, such as field trips. The challenges of insufficient professional development are well-documented in broader educational literature, highlighting the critical role of ongoing teacher training in improving educational outcomes [29][30].

Logistical and environmental constraints present further challenges in implementing traffic education. High student-to-teacher ratios, poor road conditions, and bureaucratic hurdles were frequently cited as significant obstacles, making it difficult to conduct field trips and other experiential learning activities essential for traffic education. These constraints reflect common logistical barriers that limit the feasibility of hands-on learning and disrupt educational practices.

Additionally, teachers reported that poor learner attitudes and engagement negatively impact the effectiveness of traffic education. Many students do not take traffic education seriously, particularly because it is not included in external examinations, which diminishes their motivation and involvement. This observation aligns with prevailing pedagogical trends in resource-constrained educational settings where students often disengage from subjects perceived as non-essential or non-examinable.

B. Implications for Policy and Practice

One of the primary implications of this study is the need for educational policymakers to prioritize traffic education as a core component of the pre-tertiary curriculum. Currently, traffic education is often treated as an adjunct to other subjects, with limited dedicated instructional time and resources. To address this, policymakers should develop and enforce curriculum standards that explicitly include traffic education, ensuring that it receives the attention and resources it deserves. Establishing clear learning outcomes for traffic education at different educational levels would help create a consistent approach to teaching road safety,

fostering a deeper understanding of traffic rules and safe behaviors among students from an early age.

The study also highlights the importance of investing in teacher training and professional development as a critical factor in enhancing the quality of traffic education. Policymakers and educational authorities should consider integrating traffic education modules into teacher training programs, both at the pre-service and in-service levels. Training should focus on equipping teachers with practical skills in interactive and experiential teaching methods, which have been shown to be more effective in engaging students and promoting lasting behavioral change. By providing teachers with the knowledge and tools they need, educational institutions can build a more competent workforce capable of delivering impactful traffic education.

Another key policy implication is the need for improved resource allocation to support the implementation of effective pedagogical strategies. This includes providing schools with the necessary materials, such as multimedia equipment, teaching aids, and access to digital content that enhances the learning experience. Public-private partnerships could play a crucial role in this regard, with businesses and NGOs contributing resources and expertise to support traffic education initiatives. For example, partnerships with road safety organizations could provide schools with up-to-date educational materials and facilitate workshops or school visits by traffic safety experts.

At the practice level, schools and teachers should be encouraged to adopt a more integrated approach to traffic education, incorporating road safety lessons into everyday classroom activities. This could include practical demonstrations, interactive discussions, and student-led projects that allow learners to explore traffic safety topics in a hands-on manner. Schools should also actively engage parents and the broader community in traffic education efforts, reinforcing the messages taught in the classroom and encouraging a collective approach to road safety.

The findings also suggest the importance of monitoring and evaluating the effectiveness of traffic education programs. Regular assessments of teaching methods, student learning outcomes, and the overall impact of traffic education on road safety behaviors can provide valuable feedback to educators and policymakers. This data-driven approach would enable continuous improvement of traffic education strategies, ensuring that they remain relevant and effective in addressing the evolving challenges

Conclusion

This study highlights the importance of interactive and experiential teaching methods—such as role-playing, multimedia, and field trips—in enhancing traffic education at

the pre-tertiary level. While these strategies prove more effective than traditional lectures, their implementation is often hindered by resource limitations, logistical challenges, and lack of curriculum prioritization. Addressing these barriers requires targeted support through better resource allocation, professional development for teachers, and stronger institutional commitment. Although the findings offer valuable insights, the study's reliance on self-reported data and limited geographic scope suggests the need for future research using objective measures and broader regional coverage.

Conflict of Interest

The authors declare that there is no conflict of interest.

References

- [1] Q. I. Ahmed, H. Lu, and S. Ye, "Urban transportation and equity: A case study of Beijing and Karachi," *Transp. Res. Part A Policy Pract.*, vol. 42, no. 1, pp. 125–139, 2008.
- [2] M. Oteng-Ababio and E. Agyemang, "Virtue out of necessity - Urbanisation, urban growth and Okada services in Accra, Ghana," *J. Geogr. Geol.*, vol. 4, no. 1, pp. 148–162, 2012.
- [3] G. Akyea-Darkwah, "Road Safety Education in the Ashanti and Greater Accra Regions, Ghana: Drivers' Perspectives," *Ph.D. dissertation*, Univ. of Cape Coast, 2017.
- [4] World Health Organization, *Global Status Report on Road Safety*. Geneva, 2023. [Online]. Available: <https://www.who.int/teams/social-determinants-of-health/safety-and-mobility/global-status-report-on-road-safety-2023>
- [5] P. K. Blankson and M. Lartey, "Road traffic accidents in Ghana: contributing factors and economic consequences," *Ghana Med. J.*, vol. 54, no. 3, pp. 131–131, 2020.
- [6] National Road Safety Authority, *National Road Safety Authority Act (Act 993)*, Parliament of Ghana, 2025. [Online]. Available: <https://ir.parliament.gh/handle/123456789/2005>
- [7] P. Phobun and J. Vicheanpanya, "Adaptive intelligent tutoring systems for e-learning systems," *Procedia-Soc. Behav. Sci.*, vol. 2, no. 2, pp. 4064–4069, 2010.
- [8] M. Chi, K. VanLehn, D. Litman, and P. Jordan, "Empirically evaluating the application of reinforcement learning to the induction of effective and adaptive pedagogical strategies," *User Model. User-Adapt. Interact.*, vol. 21, pp. 137–180, 2011.
- [9] D. Bligh, "What's the use of lectures?" *J. Geogr. High. Educ.*, vol. 9, no. 1, pp. 105–106, 1985.
- [10] Y. Shi, C. Peng, H. H. Yang, and J. MacLeod, "Examining interactive whiteboard-based instruction on the academic self-efficacy, academic press and achievement of college students," *Open Learn.*, vol. 33, no. 2, pp. 115–130, 2018.
- [11] M. J. Gómez-Poyato, A. Aguilar-Latorre, M. M. Martínez-Pecharromán, R. Magallón-Botaya, and B. Oliván-Blázquez, "Flipped classroom and role-playing as active learning methods in the social work degree: randomized experimental study," *Soc. Work Educ.*, vol. 39, no. 7, pp. 879–892, 2020.
- [12] X. Xu et al., "Role-playing is an effective instructional strategy for genetic counseling training: an investigation and comparative study," *BMC Med. Educ.*, vol. 16, pp. 1–10, 2016.
- [13] B. O. Omatseye, "The discussion teaching method: an interactive strategy in tertiary learning," *Educ.*, vol. 128, no. 1, 2007.
- [14] J. Bennett, S. Hogarth, F. Lubben, B. Campbell, and A. Robinson, "Talking science: The research evidence on the use of small group discussions in science teaching," *Int. J. Sci. Educ.*, vol. 32, no. 1, pp. 69–95, 2010.
- [15] L. Astuti, Y. Wihardi, and D. Rochintaniawati, "The development of web-based learning using interactive media for science learning on levers in human body topic," *J. Sci. Learn.*, vol. 3, no. 2, pp. 89–98, 2020.
- [16] A. L. Shinneman, S. Loeffler, and A. E. Myrbo, "Self-guided field trips allow flexibility in undergraduate student introductory field experiences," *J. Geosci. Educ.*, vol. 68, no. 4, pp. 371–379, 2020.
- [17] B. S. Malau-Aduli et al., "Retention of knowledge and perceived relevance of basic sciences in an integrated case-based learning (CBL) curriculum," *BMC Med. Educ.*, vol. 13, pp. 1–8, 2013.

- [18] F. Britwum and S. Aidoo, "Moral decadence as a potential predictor of students' academic performance in some selected senior high schools," *Int. J. Learn. Teach.*, vol. 14, no. 3, pp. 153–168, 2022.
- [19] Ghana Statistical Service, *Population and Housing Census General Report Volume 3A*, vol. 3A, 2021. [Online]. Available: <https://statsghana.gov.gh/gssmain/fileUpload/pressrelease/2021>
- [20] R. V. Krejcie and D. W. Morgan, "Determining sample size for research activities," *Educ. Psychol. Meas.*, vol. 30, no. 3, pp. 607–610, 1970.
- [21] Y. Baruch and B. C. Holtom, "Survey response rate levels and trends in organizational research," *Hum. Relat.*, vol. 61, no. 8, pp. 1139–1160, 2008.
- [22] R. P. Bagozzi and Y. Yi, "Specification, evaluation, and interpretation of structural equation models," *J. Acad. Mark. Sci.*, vol. 40, pp. 8–34, 2012.
- [23] K. A. Neuendorf and A. Kumar, "Content analysis," *Int. Encycl. Polit. Commun.*, pp. 1–10, 2015.
- [24] P. K. Odame, E. F. Sam, and A. Fiangor, "Exploring the nature of road safety education in basic schools and school children's travel mode options in Winneba, Ghana," *Ghana J. Geogr.*, vol. 16, no. 1, pp. 128–161, 2024.
- [25] V. K. Hung and L. T. Huyen, "Education influence in traffic safety: A case study in Vietnam," *IATSS Res.*, vol. 34, no. 2, pp. 87–93, 2011.
- [26] M. S. Zeedyk, L. Wallace, and L. Spry, "Stop, look, listen, and think: What young children really do when crossing the road," *Accid. Anal. Prev.*, vol. 34, no. 1, pp. 43–50, 2002.
- [27] S. Freeman et al., "Active learning increases student performance in science, engineering, and mathematics," *Proc. Natl. Acad. Sci. U.S.A.*, vol. 111, no. 23, pp. 8410–8415, 2014.
- [28] M. Prince, "Does active learning work? A review of the research," *J. Eng. Educ.*, vol. 93, no. 3, pp. 223–231, 2004.
- [29] K. Patton, M. Parker, and D. Tannehill, "Helping teachers help themselves: Professional development that makes a difference," *NASSP Bull.*, vol. 99, no. 1, pp. 26–42, 2015.
- [30] F. King, "Evaluating the impact of teacher professional development: An evidence-based framework," *Prof. Dev. Educ.*, vol. 40, no. 1, pp. 89–111, 2014.

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