

EFFECTIVENESS OF PEER LEARNING STRATEGY USING PSYCHOLOGICAL AND BEHAVIORAL MODELS FOR TIERED ROAD SAFETY EDUCATION

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Abstract. The rising incidence of traffic accidents among adolescents highlights the need for an educational approach grounded in behavioral psychology to enhance both cognitive and emotional aspects of road safety awareness. This study evaluates the effectiveness of a tiered peer learning strategy within the "Pejuang Muda" program, organized by the Polytechnic of Road Transportation Safety (PKTJ), implemented in two beneficiary schools: SMAN 2 Tegal and SMK AL-HUDA Bumiayu. The intervention was conducted in three stages, involving 30 students in the first stage, 60 students in the second, and 120 students in the third. Each session combined theoretical instruction with practical application on a safety road. As part of the evaluation phase, two main competitions were held, involving 11 schools and attracting over 700 participants and spectators from elementary to higher education levels. The first, the "Safety Riding Campaign Competition", assessed participants' ability to deliver road safety outreach presentations and was won by SMAN 2 Tegal. The second, the "Safety Riding Skill Competition", tested practical riding skills, including braking, navigating a narrow plank, and completing a slalom course, with SMK AL-HUDA Bumiayu emerging as the winner. The findings demonstrate that tiered peer learning is highly effective in enhancing road safety literacy and awareness among adolescents. These results support the integration of peer-led learning methods into formal curricula as a sustainable strategy to reduce traffic accidents among young people.

Keywords: road safety education, adolescent behavior, traffic accident prevention

INTRODUCTION

Road safety is a critical aspect within behavioral psychology, particularly in developing awareness and individual responsibility towards traffic risks (Dhani et al., 2023). During adolescence, the formation of safe driving behaviors becomes crucial, as this age group is particularly vulnerable to traffic accidents (Putra et al., 2021; Kemenhub, 2022). Over half of the fatalities due to traffic accidents globally involve two-wheeled vehicle users, a large proportion of whom are adolescents and young adults (WHO, 2023). The rising number of vehicles directly increases the potential for traffic accidents, both fatal and non-fatal in nature (Sukoco et al., 2025). Key components of safe driving include understanding traffic regulations, technical riding skills, situational awareness on the road, the use of safety gear, and maintaining disciplined and responsible attitudes while driving (Samekto et al., 2017; Rozikin, 2014; Faisal, 2022). In the context of educational psychology, road safety is understood as a set of cognitive, affective, and behavioral competencies that need to be developed in order to recognize potential hazards and make appropriate decisions in traffic situations (Sari et al., 2023). Therefore, early education on road safety is key to establishing a sustainable and preventative road safety culture.

Research has shown that accidents involving students are often caused by unsafe driving behaviors, such as non-compliance with traffic regulations, failure to wear helmets, driving without a license, and speeding violations (Syafitri et al., 2025). Data from the National Police Information and Security Coordination Center (2025) reported over 227,781 traffic incidents involving adolescents in 2024. Furthermore, the National Traffic Police (2022) stated that high school and vocational students account for about 25% of total traffic accidents. Most incidents occur during school commute times, indicating issues related to student driving habits. The lack of formal education on safe driving, combined with weak supervision, exacerbates this situation (Desril et al., 2018).

Socialization campaigns have become one of the primary strategies to raise awareness among adolescents about the importance of road safety (Sumantri, 2018). However, conventional one-way socialization approaches often fail to have a profound impact on adolescent behavior. Therefore, more interactive and participatory approaches are necessary to engage students in understanding and applying road safety material (Athiyah, 2024).

One effective approach to improving road safety awareness among adolescents is the Peer Learning Method (Masilamani, 2022). This educational method operates through a tiered dissemination system, where participants who have been trained pass on the knowledge to their peers. This approach not only broadens the reach and strengthens the understanding of safety material, but also fosters a sense of responsibility in each individual, as they take on dual roles as both learners and educators (Combrinck et al., 2017). Peer learning is especially effective in adolescent groups due to the similarity in age, communication style, and social context, which facilitates interaction and a deeper understanding of the material (Athiyah, 2024).

This study aims to evaluate the effectiveness of the tiered Peer Learning Method in improving road safety awareness among adolescents (Fischer, 2019). The evaluation is conducted through inter-school competitions that involve road safety education and practical skills testing. Each school will be assessed by experts based on their ability to present safety material and perform practical exercises. It is hoped that this approach will not only enhance theoretical understanding and practical skills but also motivate students to take an active role in creating a road safety culture. The success of this method is expected to provide a foundation for developing effective and sustainable participatory education strategies, which could be widely implemented in schools and student communities to reduce traffic accidents among adolescents (Matyani et al., 2024).

METHODS

Peer Learning Framework and Intervention Design

The approach used in this program is a tiered dissemination-based peer learning method, which is a tiered information dissemination system that relies on horizontal knowledge transfer between students (Masilamani et al., 2022; Fischer, 2019). In the initial stage, a small group of participants from the target schools is selected to receive intensive training on various aspects of traffic safety, including understanding traffic signs, using safety equipment (such as riding gear), and promoting a traffic safety culture.

After receiving basic training, participants have a moral and social responsibility to become peer educators for their peers (Combrinck & Govender, 2017). This process creates a dual role for participants, namely as recipients and conveyors of information. This model has been proven to enhance cognitive aspects, improve communication skills, and foster a sense of responsibility for the knowledge acquired (Susanto & Hartini, 2021).

To measure the effectiveness of this method, two types of competitions were held, serving as evaluative instruments and a means of implementing the training results, namely the Safety Riding Campaign Competition and the Safety Riding Skill Competition. These two competitions aimed to assess the extent to which participants understood and applied traffic safety material both theoretically and practically.

Safety Riding Campaign Competition

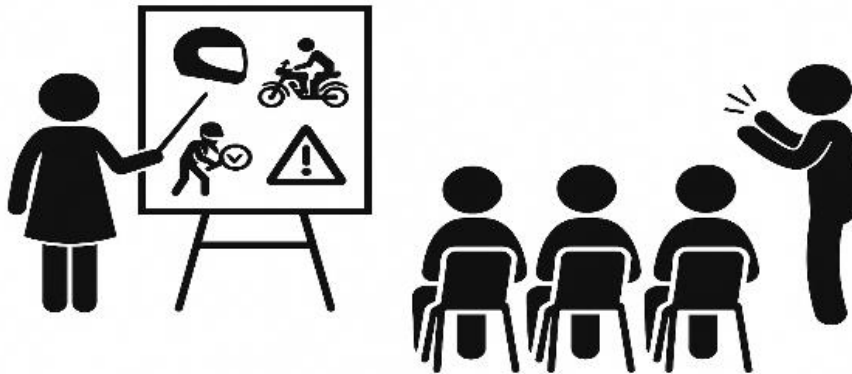


Figure 1. Safety Riding Campaign Competition

This competition is designed to test participants' ability to convey traffic safety messages in a communicative, persuasive, and structured manner, through a creative and collaborative educational approach. Each team is given a maximum of seven minutes to present their campaign in the form of an interactive briefing, using non-digital visual aids such as posters, thematic props, costumes, and other physical display media. This format was deliberately chosen to encourage spontaneity and exploration of participants' expressions without relying on digital presentation technologies like PowerPoint, thereby emphasizing the power of natural verbal communication and nonverbal gestures. The nature and components of this competition are illustrated in Figure 1, which shows the atmosphere and key elements involved in the student campaign presentations.

The assessment in this competition considers several key indicators, including the accuracy of the safety message content, creativity in delivery, the strength of the argument, and team cohesion in interacting and delivering a unified narrative. Participants are not only required to memorize or present the material but also to demonstrate a deep understanding through real-life examples, language that is easy for peers to understand, and contextual improvisation on safety issues in their respective school environments. The main topics that must be included in the campaign include:

- a. The importance of using safe riding gear, as basic protection against potential fatal injuries in accidents and as a symbol of traffic discipline.
- b. Procedures for inspecting vehicles before use, including checking the condition of brakes, tire pressure, lights, and standard equipment, which is a form of personal responsibility before driving.
- c. Compliance with traffic regulations and driving ethics, which involves moral awareness to respect fellow road users, obey road markings and signs, and avoid dangerous driving behavior.

Through this process, participants actively internalize traffic safety values and transform them into lively and inspiring public messages. This competition is not only a showcase for cognitive and affective abilities, but also a medium for strengthening the character and confidence of

participants in their role as agents of change. They learn to communicate ideas clearly, build meaningful interactions with their audience, and foster collective awareness among fellow students. This aligns with the peer-led education approach, which places teenagers at the center of efforts to create a community-based safety culture.

Safety Riding Skill Competition



Figure 2. Safety Riding Skill Competition

The second competition tested participants' practical driving skills through a series of technical obstacles, conducted in collaboration with Astra Honda Motor (AHM). A visual overview of the technical components and competition flow is presented in Figure 2, capturing the essence of the practical skill evaluation. The challenges included:

- a. Braking skill: the ability to brake suddenly and accurately.
- b. Narrow plank: maintaining balance on a narrow board without touching the ground.
- c. Slalom course: maneuvering on a winding course that requires control of speed and body position.

The aspects assessed include the use of riding gear, vehicle checks, body position while riding, braking techniques, as well as accuracy and timing. Participants who fail to maintain balance or stray from the track will be disqualified.

The implementation of these two competitions serves as a benchmarking tool for the target school to compare itself with other schools. This aims to assess the concrete impact of the systematic and tiered peer learning intervention. The success of participants from the target school in the competition serves as evidence of the effectiveness of this approach in fostering safe and responsible riding behavior.

Implementation Stages and Training Flow

The program is implemented through three stages of tiered training, designed to systematically expand the scope of traffic safety education through a peer-to-peer approach. Each stage is built on the principle of horizontal replication, whereby participants not only receive training materials, but also have an obligation to disseminate them to their peers in their respective school environments. The growth of peer educators across the three stages is depicted in Figure 3, showing the scale-up process from the initial 30 participants to a final group of 120.

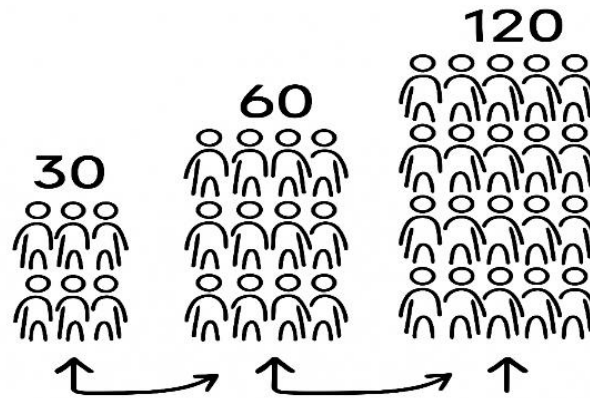


Figure 3. Training Flow

Phase Initial Selection and Foundational Training

The first phase began with the selection of 30 students from three designated mentoring schools: SMAN 2 Kota Tegal, SMAN 5 Kota Tegal, and SMKN 3 Kota Tegal. Participants were selected based on school recommendations, with a focus on leadership potential, communication skills, and a willingness to engage in community-based educational initiatives. The selected students received intensive training from the Pejuang Muda Keselamatan Jalan PKTJ Batch III, which included on theoretical and practical aspects of traffic safety, basic riding skills, legal traffic regulations, and effective campaign techniques.

Phase Peer Duplication and Knowledge Reapplication

In the second phase, each trained participant was tasked with recruiting at least one peer and transferring the knowledge they had acquired to them. This stage expanded the participant base to 60 students. The training in this phase focused on reinforcing core knowledge while enhancing participants' interpersonal communication and facilitation abilities. Participants also engaged in co-facilitation activities alongside the primary trainers, thus beginning to exercise their role as peer educators through guided practice.

Phase Broad Dissemination and Community Network Formation

The third and final stage repeated the peer recruitment strategy, bringing the total number of trained student participants to 120. The structure remained consistent, integrating theoretical modules and practical components—but placed stronger emphasis on developing the students' capacity as independent facilitators. By this stage, peer educators were expected to organize and lead their own campaign simulations and mini-trainings, forming micro-communities of safety awareness within their schools.

This tiered training structure ensured not only the scaling of participation, but also the depth of understanding and behavioral internalization. Each cycle reinforced the roles of learners as knowledge multipliers and behavior models, aligned with the principles of participatory youth empowerment and behavioral psychology (Velez & Han, 2023).

The comprehensive flow of training, knowledge content, and evaluation methods applied in this program are summarized in the conceptual model below (Figure 4), which illustrates the cyclical integration between theory, practice, and competition-based assessment.

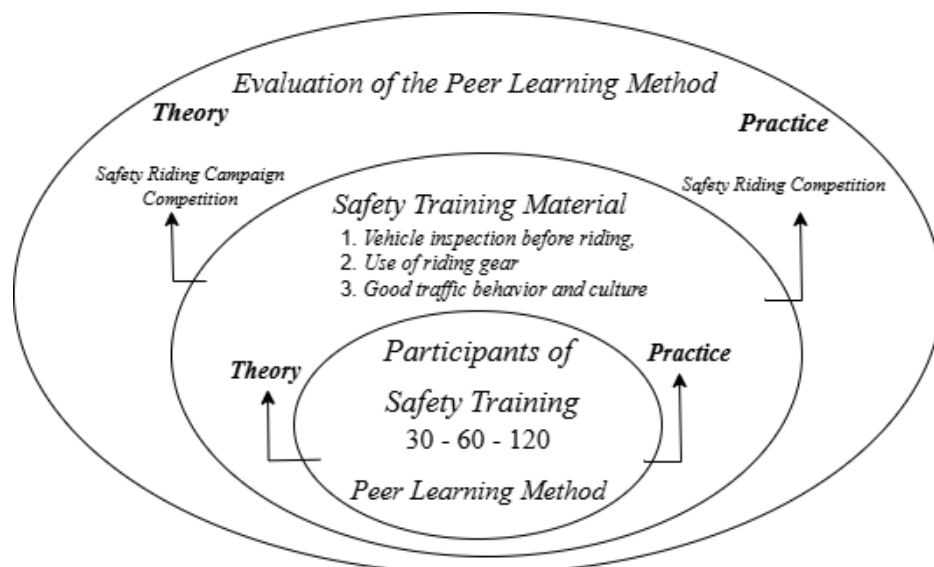


Figure 4. Conceptual Model of Tiered Peer Learning Integration and Evaluation

RESULTS AND DISCUSSION

Evaluation of Peer Learning Outcomes

The evaluation of the Young Road Safety Warriors program was conducted through two types of competitions: the Safety Riding Campaign and the Safety Riding Skill, involving participants from 11 schools. These two competitions were designed to measure the success of the peer learning method in improving understanding, communication, and actual riding skills. The results of each competition are described in the following subsections.

Cognitive and Communicative Outcomes (Campaign Competition)

The safe driving campaign competition serves as an evaluation tool to measure participants' mastery of traffic safety material and their ability to communicate it in a communicative and persuasive manner. Each participating team is given a maximum of seven minutes to deliver an educational message directly without the aid of digital media. Presentations are made using physical visual aids such as posters, costumes, thematic props, and other creative media, with the aim of emphasizing spontaneity, team interaction, and verbal and nonverbal expression.

The assessment of this competition encompasses four main aspects: the accuracy of message content, the creativity of presentation, the effectiveness of verbal and nonverbal communication, and teamwork. This approach reflects the core principle of peer-led education, where information conveyed by peers is more easily accepted because it uses language, expressions, and perspectives that are socially relevant (Combrinck & Govender, 2017; Susanto & Hartini, 2021).

Of the 11 schools that participated, three partner schools —SMAN 2 Kota Tegal, SMAN 5 Kota Tegal, and SMKN 3 Kota Tegal —performed the best. The teams from these schools were able to develop a well-structured campaign message, deliver information with high confidence, and effectively utilize visual elements to support their narrative. The clarity of the message presented by participants from SMAN 2 Kota Tegal specifically demonstrated a deep understanding of road safety, including the importance of using personal safety gear (riding gear), vehicle inspections before driving, and traffic etiquette.

Overall, the results of this competition indicate that peer learning methods not only strengthen participants' cognitive aspects but also enhance their interpersonal communication skills and

confidence in conveying safety values to their peers. This aligns with the findings of Masilamani et al. (2022), which emphasize that the peer learning approach enables the internalization of preventive attitudes through active involvement in conveying information. This approach also enriches the meaning of learning because students are not only objects receiving information but also agents conveying messages, which naturally strengthens their mastery of the material.

Practical and Behavioral Outcomes (Skill Competition)

The driving safety skills competition was held as a means of evaluating participants' technical abilities and behavior in applying safety materials directly in the field. This activity involved more than 700 students from 11 high schools/vocational schools/Islamic high schools, with various technical challenges designed to measure participants' skills, discipline, and driving reflexes. The competition assessed participants' abilities through three types of riding challenges: braking skill, narrow plank, and slalom course.

The assessment is based on the use of riding gear, vehicle inspection, body posture while riding, as well as the accuracy of technique and time taken to complete the obstacles. Participants who fail to maintain their balance or deviate from the course are disqualified. This evaluative approach is designed to mimic real-life conditions that require high concentration, quick decision-making, and discipline in applying safety standards.

Participants from non-affiliated schools such as SMA Al-Huda Bumiayu, SMK N 1 Bulakamba, and SMK Bismakersana recorded the best times and showcased the most stable riding techniques. Additionally, supported participants were noted for their precise braking, proper body positioning, and full compliance with riding gear standards.

From a behavioral perspective, participants who underwent peer learning training demonstrated higher awareness of the importance of vehicle inspections before riding, as well as improved habits in using safety equipment even outside of competitions. This suggests that peer-based methods have an impact not only on cognitive aspects but also on internalizing safe riding discipline as a genuine habit in real life.

These findings align with studies by Putra & Sari (2021) and Sari et al. (2023), which state that experience-based interventions and direct training are far more effective in shaping teenage traffic behavior than one-way lectures. The peer-to-peer approach allows for deeper social interaction, facilitating collaborative reflection and more authentic behavior modeling. Thus, this skills competition not only tests participants' motor skills but also serves as an indicator of the success of character development in terms of discipline and responsibility in safe driving.

Method Effectiveness and Sustainability

The results of the two evaluation campaign competitions and the riding skill competition demonstrate that the tiered peer learning approach has been effective in enhancing students' conceptual understanding, technical proficiency, and behavioral discipline regarding road safety. Participants from the designated mentoring schools consistently performed at a high level, presenting structured messages, precise execution, and strong discipline in the use of safety equipment.

This is further illustrated in Figure 5, which shows that 100% of the mentoring schools became winners in the competitions, while none of the non-mentoring schools achieved a similar outcome. This data highlights the direct impact of the structured intervention in shaping competitive and safety-aware student behavior.

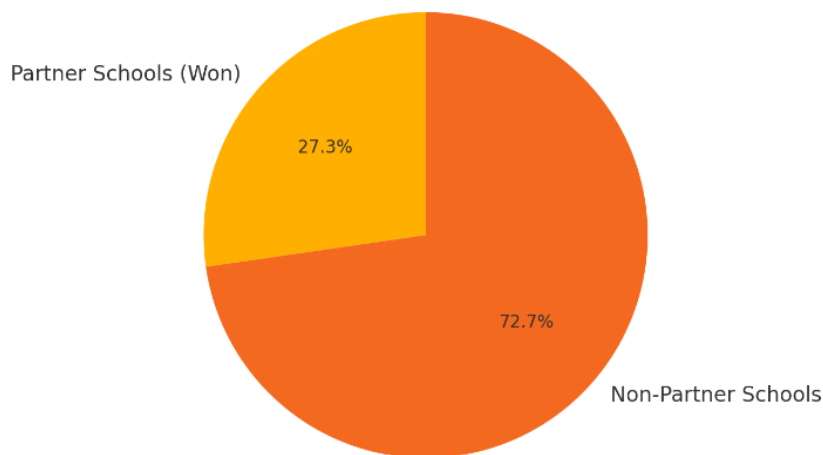


Figure 5. Percentage of Winning Schools in Competitions

Theoretically, these findings support the notion that peer-based learning can enhance cognitive understanding while promoting behavioral change (Combrinck & Govender, 2017; Susanto & Hartini, 2021). The mechanism of horizontal knowledge transfer enables learners to relate to the content delivered by peers more socially and emotionally, rather than through conventional top-down instruction. This aligns with the findings of Masilamani et al. (2022), who emphasized the significant impact of peer-led road safety education in shaping adolescents' positive attitudes.

From a program design perspective, the structured tiered dissemination (from 30 to 60 to 120 participants) establishes a scalable and replicable learning model. Each phase not only increased participant numbers but also strengthened their capacities as change agents within their school environments. This structure aligns with the principles of the "train-the-trainer" model, a widely adopted approach in various community-based educational programs (Velez & Han, 2023).

Compared to other studies, such as those by Putra, Lestari, and Ramadhan (2021) and Sari and Nugroho (2022), this study offers additional value in integrating a tiered dissemination system with performance-based evaluation. The dual-format competitions (campaign and skill-based) ensured that understanding was not merely assessed theoretically, but also through real performance and public demonstration.

In terms of sustainability, the outcomes suggest a strong potential for the long-term integration of the model into school curricula, particularly in areas such as character education, life skills, and extracurricular activities. Moreover, strategic partnerships with external institutions such as Astra Honda Motor, Jasa Raharja, and the National Police offer valuable opportunities for multisectoral support to further embed student-led road safety advocacy. The peer-led tiered learning model proves not only effective in the short term but also promising as a strategic and sustainable educational framework for instilling road safety culture among youth.

CONCLUSION

The Young Road Safety Warriors Program has successfully demonstrated that a tiered dissemination-based peer learning approach is effective in increasing awareness, understanding, and driving safety skills among students. Participants from partner schools demonstrated superior performance in two types of competitions designed as evaluation tools, both in terms of communication and outreach, as well as technical driving skills.

This model not only strengthens conceptual understanding but also encourages participants to become effective messengers capable of reaching their peers. The horizontal knowledge transfer process, built in a tiered manner, creates a multiplier effect in the dissemination of safety values and fosters disciplined habits through direct practice.

Based on these results, it can be concluded that the peer-led education method applied in a tiered format is worthy of consideration as a strategic approach in traffic safety education. With proper integration into the school environment and cross-sectoral support, this model has the potential for sustainability in fostering a strong safety culture among the younger generation.

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