



TADULAKO JOURNAL SPORT SCIENCES AND PHYSICAL EDUCATION
PHYSICAL EDUCATION, HEALTH, AND RECREATION STUDY PROGRAM
EDUCATION SCIENCE DEPARTMENT
TADULAKO UNIVERSITY, PALU, INDONESIA
<https://jurnalfkipuntad.com/index.php/tjsspe/index>
E-ISSN 2581-0383 | P-ISSN 2337-4594



IMPROVING T-KICK ACCURACY IN PENCAK SILAT THROUGH ROPE LIMITER FOCUSED TRAINING: A TRAUMA-FREE APPROACH FOR BEGINNER STUDENTS

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Article History: Accepted Mei 2026, Approved Mei 2026, Published June 2026

ABSTRACT

This study aims to test a focused training method, that is with a rope barrier to an increase in T-kick accuracy and the safety of students in practicing pencak silat for beginners. The study was prompted by two general problems in novice training, the first being poor kicking accuracy and the second being that rigid training equipment can also cause injuries. Data this study used a quantitative research approach with quasi-experimental nonequivalent control group design. In total, 111 students from 18 dynamic physics classes participated in the study, with 57 of them as the experimental group and the remaining 54 students as control. The experimental group were trained with a rope, whereas the control group trained on chair-based media. The overall T-kick accuracy (the sum of scores in each category) was recorded via a 5-point biomechanical evaluation criterion, which consisted of stance position followed by the combination move trajectory: body balance, leg and target just prior to impact and through. The data were analyzed by the Wilcoxon Signed Rank Test and Mann-Whitney U Test. Results In both groups, the pre-test showed significant a better improvement after attending these training sessions (experimental group: $p < 0.001$; control group: $p < 0.001$). Nevertheless, the difference between groups is not meaningful ($p = 0.800$) meaning both training methods improved T-kick accuracy steady state to similar values. Despite this, the rope barrier served as a safer and more versatile training environment by minimising impact compared with rigid chair media. Conclusions The rope barrier is an alternative to simple, low-cost, and safe for basic training of pencak silat in primary education level.

Keyword: *Focused Training Method, Injury Prevention, Motor Learning, Pencak Silat, Rope Limiter, T-kick Accuracy*



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INTRODUCTION

Pencak silat has evolved beyond its identity as a traditional Indonesian martial art into an internationally recognized competitive sport with standardized rules, scoring systems, and biomechanical performance demands. Since its inscription on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity, pencak silat has increasingly been positioned

within the global sport science framework as a combat sport requiring high levels of technical precision, tactical efficiency, and movement control (UNESCO, 2019). In modern competition settings, scoring success is strongly influenced by athletes' ability to execute accurate and efficient attack techniques under dynamic movement conditions. Consequently, technical mastery in pencak silat is no longer viewed solely as cultural preservation, but as a performance-oriented competency closely related to biomechanical efficiency, neuromuscular coordination, and motor learning adaptation.

Among the various attack techniques used in pencak silat competitions, the T-kick represents one of the most strategic scoring tools because it enables athletes to generate direct points through fast lateral movement, broad attack reach, and difficult defensive anticipation. The execution of the T-kick requires simultaneous coordination between balance stabilization, lower limb trajectory control, hip rotation, body alignment, and contact precision during dynamic motion transitions. Biomechanical studies in combat sports indicate that successful kicking performance depends on the integration of movement speed and target accuracy under complex motor coordination demands (Wąsik et al., 2021). In martial arts performance, movement precision is strongly associated with proprioceptive control, postural stability, and repeated neuromuscular adaptation developed through systematic training processes. Furthermore, motor learning research demonstrates that repetitive movement exposure contributes to neural plasticity, enabling learners to refine movement efficiency and coordination through continuous proprioceptive feedback mechanisms (An & Wulf, 2024). Therefore, beginner T-kick training requires structured learning environments capable of simultaneously supporting movement repetition, body stabilization, and accurate movement guidance.

This issue becomes increasingly important in elementary school students because childhood represents a critical developmental period for motor skill acquisition and movement pattern formation. Previous studies have explained that school-age children experience rapid neuromuscular and coordination development, making this phase highly important for establishing fundamental movement skills and long-term motor competence (Messer et al., 2022). During the associative stage of motor learning, learners gradually refine movement quality by reducing errors, improving coordination, and stabilizing movement consistency through repeated corrective feedback. However, many beginner students still experience difficulties in performing accurate T-kicks due to unstable balance, poor inter-limb coordination, limited proprioceptive awareness, and inadequate learning media that fail to provide clear movement references. In addition, fear of injury caused by rigid training equipment may psychologically inhibit students from performing movements confidently, thereby disrupting the motor learning process and limiting movement exploration during practice sessions. Previous research has similarly reported that anxiety, fear of injury, and inadequate practice environments may negatively affect movement confidence and motor performance among beginner learners (Ramamoorthy et al., 2021).

In practical learning environments, teachers commonly use conventional media such as chairs or rigid barriers to guide kick height and movement direction. Although these media are intended to improve movement accuracy, they also create a pedagogical paradox in which efforts to increase technical precision may unintentionally expose students to greater physical and psychological risk. Rigid training objects increase the possibility of accidental collision, fear of impact, and movement hesitation among beginner learners. Such conditions are inconsistent with the concept of a trauma-free training environment, which emphasizes psychological safety and adaptive movement exploration during early motor learning stages. Recent global discussions in combat sport pedagogy and injury prevention increasingly emphasize the importance of safer and more adaptive training environments, particularly for children and novice athletes (Kirk et al., 2024). Injury prevention has become a major concern in martial arts because repetitive impact exposure and unsafe training conditions significantly contribute to training-related injuries among beginner practitioners (Virghani et al., 2025). Therefore, learning media should not only

function as movement guides for technical accuracy, but also as safety-oriented tools capable of minimizing collision risk during repetitive kicking practice.

From a motor learning perspective, training media play an essential scientific role because they function as external task constraints capable of shaping learners' movement adaptation and attentional focus. According to the ecological dynamics approach, motor skill acquisition emerges through continuous interaction between the learner, the task, and the environment (Heuvelmans et al., 2024). Within this framework, movement boundaries or visual constraints help learners self-organize movement solutions more effectively by directing attention toward external targets and environmental cues. This mechanism aligns with the concept of external focus of attention, where learners achieve more stable and efficient movement performance when concentration is directed toward movement outcomes rather than internal body mechanics alone. Recent studies demonstrated that external attentional focus significantly enhances movement automaticity, performance consistency, and motor learning effectiveness in sports contexts (Mohammadi Sanjani et al., 2023). Therefore, movement-limiting media may contribute not only to technical correction, but also to improved perceptual-motor adaptation during skill acquisition.

Previous studies reported that focused and repetitive training significantly improves technical mastery in pencak silat, particularly among beginner athletes (Satria et al., 2022). Similarly, movement-limiting training media improve kick direction understanding and movement consistency during basic technique practice (Dimas Abdulrahman, Edi Purnomo, 2021). However, existing studies predominantly focus on technical performance outcomes without simultaneously examining the safety implications of movement restriction media in beginner training contexts. In addition, conventional movement barriers used in previous training methods were generally rigid objects that may increase impact risk during repetitive kicking exercises. This indicates a clear research gap regarding the development of training media that are simultaneously effective for improving movement accuracy and adaptive for injury prevention among beginner learners. Mechanically, the rope limiter differs from other flexible training media because it provides adjustable spatial constraints while simultaneously minimizing rigid-body impact forces during repeated kicking movements. Unlike foam barriers or elastic pads that still generate direct rebound forces upon contact, the rope limiter functions primarily as a visual-spatial guide with minimal collision resistance, allowing learners to maintain movement exploration with lower psychological and biomechanical risk.

Based on these considerations, the present study proposes the use of a rope limiter as an alternative focused training medium for improving T-kick accuracy among beginner elementary school students. Unlike rigid conventional barriers, the rope limiter functions simultaneously as a task constraint for directing movement trajectory and as a safety guard for minimizing impact-related injury risk during repetitive practice. The flexibility of the rope creates a more adaptive, low-cost, and psychologically safer training environment while still maintaining movement guidance functions necessary for motor learning optimization. Therefore, this study aims to analyze the effect of focused training using a rope limiter on T-kick accuracy in pencak silat and to examine its practical implications as a functional-equivalent yet safer alternative to conventional training media in elementary-level martial arts instruction.

METHOD

This study employed a quantitative approach using a quasi-experimental method with a nonequivalent control group design. The design was selected because the research was conducted in a natural school setting where random assignment of students into groups was not possible due to existing classroom structures. The nonequivalent control group design is commonly applied in educational and school-based intervention research where random assignment is difficult to implement under natural classroom conditions (Creswell & Creswell, 2017). Methodologically, this design enabled the researchers to evaluate the effectiveness of the

focused training method using a rope limiter as an intervention for improving T-kick accuracy while maintaining the ecological validity of the school learning environment. The design also allowed comparison between an experimental group receiving rope-limiter-based focused training and a control group receiving conventional chair-based training. This study was conducted from January to April 2026 for one week, meeting twice on Tuesday and Wednesday at Margamukti Elementary School, Sumedang Regency.

The population consisted of all fifth- and sixth-grade students who had never participated in intensive pencak silat programs or activities and were considered beginners. Saturated sampling was employed, resulting in a total sample of 111 students consisting of 57 students in the experimental group and 54 students in the control group. Fifth-grade students were assigned to the experimental group, while sixth-grade students were assigned to the control group. Considering the potential risk of biological maturation bias between grade levels, several mitigation procedures were implemented. Previous studies have reported that differences in biological maturation among school-age children may influence motor coordination, physical performance, and movement skill development, thereby potentially affecting the comparability of experimental groups in youth-based physical education research (Kim et al., 2021). First, all participants were classified as beginner practitioners who had never participated in professional pencak silat clubs or formal martial arts competitions. Second, baseline equivalence was examined through pretest analysis, which demonstrated relatively homogeneous initial T-kick accuracy scores between groups. Third, all participants trained under similar environmental conditions, training schedules, and instructional supervision to minimize external variability affecting motor performance.

The inclusion criteria were: (1) students aged 10–12 years, (2) physically healthy and able to participate in physical activity, (3) all are still beginners and have never participated in intensive pencak silat training. Exclusion criteria included: (1) students who experienced musculoskeletal injuries during the intervention period, (2) students absent for more than two intervention sessions, and (3) students who did not complete either the pretest or posttest assessment. Gender distribution was also documented because motor development characteristics in school-age children may differ between males and females. Previous studies have shown that biological and developmental differences between boys and girls may influence motor coordination, movement performance, and physical activity patterns during childhood and early adolescence (Barnett et al., 2022). The experimental group consisted of 31 male and 26 female students, while the control group consisted of 29 male and 25 female students.

The independent variable in this study was the focused training method using a rope limiter, while the dependent variable was T-kick accuracy in pencak silat. In this study, accuracy was operationally defined as the biomechanical correctness and movement precision demonstrated during T-kick execution, rather than solely target impact success. Accuracy assessment referred to movement quality indicators adapted from biomechanical movement analysis in martial arts, including the initial stance phase, body alignment and kick trajectory, balance stability, target-contact precision, and follow-through movement (Pratama & Candra, 2021). Assessment was conducted using a 5-point biomechanical rubric scale ranging from 1 (very poor execution) to 5 (excellent execution) for each movement component (Info, 2021).

Data collection was conducted through direct observation and video-based analysis during pretest and posttest sessions. Video recording was performed using a smartphone camera with 1080p Full HD resolution at 60 frames per second positioned laterally at a distance of approximately 3 meters from the kicking area. Video-based assessment was employed to improve observational consistency and facilitate repeated movement analysis during scoring procedures. Previous studies indicate that video-based visual feedback and observational analysis improve the accuracy, reliability, and consistency of motor skill assessment in physical education and sports performance contexts (Chen et al., 2026). The intervention program consisted of six training sessions conducted over three weeks with a frequency of two sessions per week. Each session lasted approximately 60 minutes, including warm-up, core training drills, and cooldown

phases. The experimental group performed focused T-kick drills using a rope limiter as a movement boundary, while the control group used chair-based barriers as conventional training media. To ensure equivalence between groups, chair height in the control group was adjusted to correspond with the average rope height used in the experimental group. Both groups received identical training volume, movement repetitions, and instructional duration.

Session	Warm-up (10 min)	Core Drill (40 min)	Sets × Repetitions	Interval	Cooldown (10 min)
1	Dynamic stretching and mobility	Introduction to T-kick mechanics	3 × 8	60 sec	Static stretching
2	Dynamic movement drills	Balance and trajectory training	3 × 10	60 sec	Breathing exercises
3	Coordination drills	Focused T-kick practice using rope limiter/chair barrier	4 × 8	90 sec	Flexibility training
4	Agility warm-up	Repetitive directional T-kick practice	4 × 10	90 sec	Muscle relaxation
5	Dynamic balance exercises	Accuracy and follow-through drills	4 × 10	90 sec	Static stretching
6	Combined mobility drills	Integrated T-kick performance practice	5 × 8	120 sec	Recovery exercises

Table 1. Focused Training Program Structure

Safety observation procedures were implemented throughout the intervention period because injury prevention constituted one of the major focuses of the study. Researchers recorded all accidental collisions, unsafe movement incidents, and complaints of physical discomfort occurring during training sessions. The rope limiter was specifically selected because its flexible material minimized direct physical impact risk compared to rigid chair-based barriers. This study received approval from the school administration and the physical education teacher. Written informed consent was obtained from parents or legal guardians before participants were involved in the study. All procedures were conducted in accordance with ethical principles for research involving children and educational participants. Descriptive and inferential statistical analyses were conducted using IBM SPSS Statistics version 26 with a significance level of $\alpha = 0.05$. Prior to hypothesis testing, data normality was examined using both Kolmogorov-Smirnov and Shapiro-Wilk tests. Because the data distribution was not normal, non-parametric statistical analyses were employed. The Wilcoxon Signed Rank Test was used to examine within-group differences between pretest and posttest scores, while the Mann-Whitney U Test was used to analyze differences in gain scores between the experimental and control groups.

RESULTS

This study involved 111 elementary school students consisting of 57 students in the experimental group and 54 students in the control group. The experimental group received focused training using a rope limiter, while the control group participated in conventional chair-based training. Data were obtained through pretest and posttest assessments to evaluate changes in T-kick accuracy following the intervention period. Prior to hypothesis testing, normality analysis was conducted using both the Kolmogorov-Smirnov and Shapiro-Wilk tests. The results indicated that several significance values were below 0.05, demonstrating that the data

were not normally distributed. Therefore, non-parametric statistical procedures were applied for subsequent analyses.

Variable	Test	Statistic	df	Sig.
Experimental Pretest	Kolmogorov-Smirnov	0.350	57	0.000
Experimental Pretest	Shapiro-Wilk	0.744	57	0.000
Experimental Posttest	Kolmogorov-Smirnov	0.320	57	0.000
Experimental Posttest	Shapiro-Wilk	0.722	57	0.000
Control Pretest	Kolmogorov-Smirnov	0.313	54	0.000
Control Pretest	Shapiro-Wilk	0.778	54	0.000
Control Posttest	Kolmogorov-Smirnov	0.226	54	0.000
Control Posttest	Shapiro-Wilk	0.806	54	0.000

Table 2. Normality Test Results

The descriptive statistical analysis showed that the mean score increased from 3.07 in the pretest to 4.14 in the posttest, indicating improved T-kick accuracy after the intervention. In addition, the standard deviation values indicated more consistent movement performance following the training sessions.



Figure 1. Focused T-Kick Training Using Rope Limiter Media



Figure 2. Conventional Chair-Based Barrier Training During T-Kick Practice

Variable	N	Min	Max	Mean	Std. Deviation	Std. Error	Variance
Pretest	111	2	4	3.07	0.599	0.057	0.358
Posttest	111	3	5	4.14	0.681	0.065	0.463

Table 3. Descriptive Statistics of Pretest and Posttest Scores

Both groups demonstrated improvement in posttest scores following the intervention. The experimental group showed a slightly higher gain score compared to the control group, although both groups experienced similar patterns of improvement.

Group	Pretest Mean	Posttest Mean	Gain Mean	Std. Error	Variance
Experimental	3.08	4.15	1.07	0.074	0.316
Control	3.05	4.11	1.05	0.076	0.318

Table 4. Mean Scores by Group

To provide a clearer illustration of score improvement distribution among students, frequency distribution analysis was conducted to identify shifts in score categories between the pretest and posttest assessments.

Score	Pretest Frequency	Posttest Frequency
2	16	0
3	71	19
4	24	58
5	0	34

Table 5. Frequency Distribution of T-Kick Accuracy Scores

The frequency distribution results showed that students who initially obtained lower scores during the pretest shifted toward higher score categories in the posttest assessment. This finding indicates measurable improvement in T-kick performance following the intervention program. The results of the Wilcoxon Signed Rank Test showed that both groups experienced significant improvement in T-kick accuracy after the intervention.

Group	Z	Sig. (2-tailed)	Interpretation
Experimental	-6.688	0.000	Significant Improvement
Control	-6.364	0.000	Significant Improvement

Table 6. Wilcoxon Signed Rank Test Results

This proves that training through rope limiters and training through chairs are equally effective for developing accurate T kicks. This result is further explained by the theory of repetitive practice, which suggests that practicing an action repeatedly increases neuromuscular coordination and consistency and stabilizes the learned skills.

There was no statistically significant difference between the experimental group and the control group based on the results of the Mann-Whitney U Test.

Variable	Mean Rank Experimental	Mean Rank Control	Sig. (2-tailed)	Interpretation
Gain Score	56.68	55.28	0.800	No Significant Difference

Table 7. Mann-Whitney U Test Results

Based on the results obtained from the data analysis, the training programs were equally effective in increasing the accuracy of T-kicks for beginner students. Given that safety was one of the main issues discussed in this research, safety assessments were also done throughout the experiment to determine instances of collision, body pains, and hesitancy during training exercises.

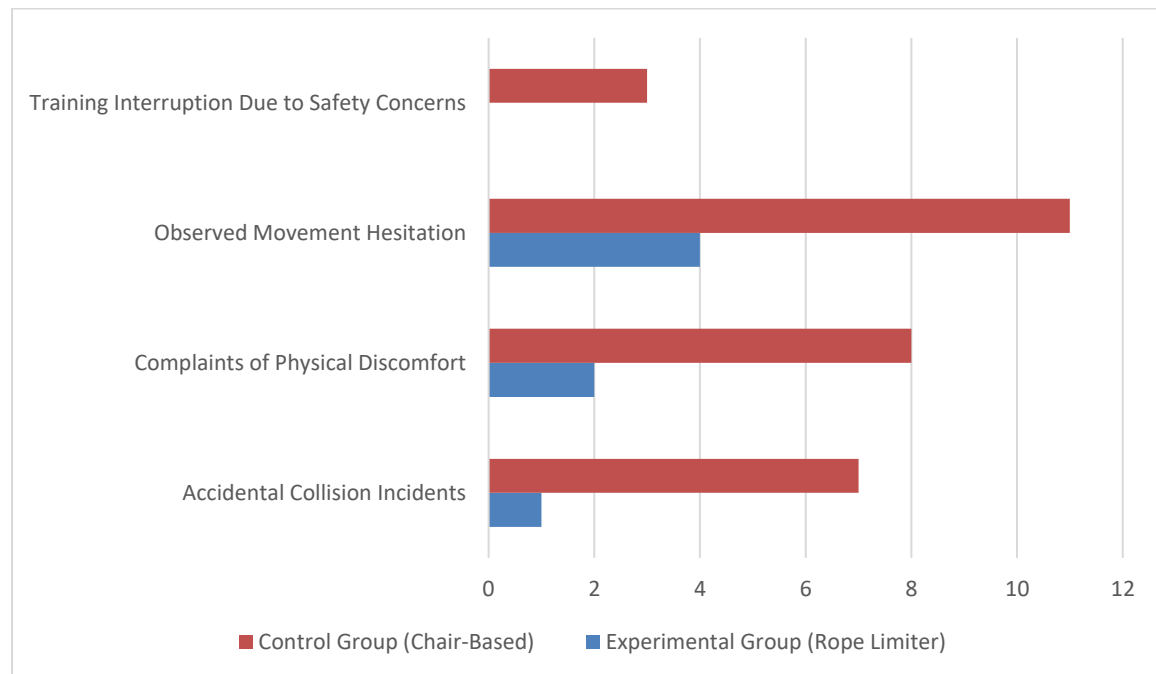


Figure 3. Safety Observation Results During Intervention

It was clear from the safety observation result that using the rope limiter resulted in a safer learning environment compared to the traditional media based on the stiff chair. The test group had fewer instances of collisions, less physical complaints, and fewer movement hesitations when doing their exercises. This suggests that the rope limiter is a safe medium for the T-kick exercise for beginners.

DISCUSSION

The purpose of this study was to determine whether focused training with the use of a rope limiter and traditional chair based training could improve T-kick accuracy in elementary school students. That present pain was important, but the most significant thing we found related to positive progress did not concern simply a skill. That finding largely surrounded the development of a trauma-free training environment via implementation of rope limiter media. Results: A lower rate of torso collisions, physical discomfort complaints, and hesitant movement in the experimental group suggested flexible training media prevent injury from occurring among novice martial artists. IMPORTANCE: This has contemporary international relevance due to current global interest in the prevention of injury in combat sports and martial arts training settings. The results are in line with previous studies that have found collision and impact-related injuries are still common in pencak silat training and competition, especially among novice and adolescent athletes (Virghani et al., 2025). Therefore, more adaptive and softer training methods could be helpful to create safer learning environments in the early development of motor skills.

The rope limiter also, perhaps, produced a more forgiving space in which students could hone their practice responses. Flexible media decrease apprehension to impact and hesitation to movement as compared to rigid chair-based media. In novices, fear of injury might obstruct

confidence and motor adaptation during the skill acquisition of new movement skills (Blomqvist Mickelsson & Stylin, 2021). The experimental group showed less hesitation, indicating that the students were more willing to repeat the kicks without worrying too much about the risk of collision. This state promotes the associative phase of motor learning, during which learners gradually enhance their movement efficiency and coordination by repeated corrective practice (Tassignon et al., 2021). The improvement of T-kick accuracy in both groups is consistent with the theory of repetitive practice in motor learning. Repeated movement execution during the six intervention sessions likely contributed to neuromuscular adaptation and motor stabilization processes. Modern neuroscience studies show that repeated motor practice leads to neural plasticity, structural and functional adaptation in motor-related neural pathways. The repetition of continuous movement strengthens sensory-motor integration and contributes to the consolidation of motor memory during the acquisition of a skill (Azzarito et al., 2023).

Proprioceptive feedback mechanisms may also explain changes in both groups as they showed a consistent pattern of improvement. In the repeated feedback that students received while practicing kicks, they were continuously informed of information relative to balance control, kicking angle, body posture and target orientation. Here, regular sensory feedback probably enabled better movement consistency and kicking precision. The rope limiter provided a more explicit spatial reference to assist students in stabilizing the direction of movement and orientation of their bodies while practicing during gait analysis. In the literature, proprioceptive feedback is known to enhance coordination and adaptive motor control during Motor Learning Contents (Mulloney et al., 2014). An additional key point of the rope limiter intervention lies in external focus of attention. It pushed the students to think about moving toward external movement targets and not overly about internal leg mechanics. International studies prior to the present one universally concluded that external focus was more effective than internal focus for movement efficiency, balance control and motor performance skills acquisition. Answer. The rope limiter served as an external cue to provide students with a visual reference for directing their kicks and aiming at the target while practicing their skills repeatedly (Grgic et al., 2021).

When considering the slightly larger effect size observed for the experimental as compared to the control group, it can be concluded that although an observable difference was present between groups, statistically both methods performed at equivalent levels. As such, the results should not be interpreted as an indication of failure for the rope limiter intervention. On the contrary, our results confirmed rope limiter media were as effective as conventional chair-based methods in enhancing T-kick accuracy among inexperienced students. This is an important finding, on a pedagogical note, because the rope limiter showed equivalent functional outcomes while creating a safer training environment. Earlier studies have described that using structured training media and guiding movement practice can enhance the quality of motor learning, movement accuracy, and learning objectives safely for novice learners (Ramamoorthy et al., 2021). Equal practice volume during intervention may also have an influence on the similarity of improvement outcomes between groups. Both groups had the same number of sessions, duration of exercise, repetitions and exposure to instructions. Therefore, the media itself may not have been the primary factor responsible for the motor improvement, but rather the amount of practice per se. Repeated exposure to similar movement patterns most likely enhanced movement familiarity, coordination stability and motor adaptation in both groups (Kweon et al., 2023).

The lack of negative ranks in the Wilcoxon analysis is also an important pedagogical finding. No students had a performance decrease after the intervention process, which indicates that both training methods were equally effective in promoting skill improvement and did not negatively affect movement performance. This finding is consistent with the interpretation that the intervention procedures were adaptive and safe for the learners at the beginner level. Similarly, previous research on motor adaptation reported that repetitive and progressive movement practice generally improves movement stability and reduces performance decline during learning phases (Bhatt et al., 2023). However, despite these positive results, several

factors should be interpreted with caution. The mean scores at posttest were close to the upper limit of the assessment scale, indicating the possibility of a ceiling effect within the measurement instrument. Because the maximum score was limited to five points, the instrument might have become less sensitive to distinguish higher level of movement improvements after repeated practice sessions. Future studies might therefore need to use more complex biomechanical assessment parameters to capture advanced performance variation in a more precise way. Previous measurement studies have described that ceiling effects can lead to a reduction of instrument sensitivity in cases where participants score near the maximum score of the assessment (Forero et al., 2023).

This study has several uncontrolled variables that may interfere with its research results. During the intervention, the study did not statistically measure four factors: student motivation, lower limb muscle strength, physical fitness, and prior exercise experience. We cannot verify the influence of these variables on improvements in T-kick, so all relevant interpretations must be made with caution. Previous studies in the fields of athletic performance and physical fitness also confirm that such variables can substantially impact exercise adaptation and motor skill performance (Park & Jeong, 2023). A further constraint relates to the selection of fifth graders as the experimental group and sixth graders as the control group. While pretest analysis had shown considerable similarities in baseline data, differences in biological maturity could create possible biases due to variations in coordination readiness and physical development. Nonetheless, the high degree of similarity in baseline data and steady trends of improvements in both groups ensured the validity of the experiment's results. Prior research in child development has suggested that age and maturation may affect coordination readiness, adaptation of movements, and motor achievements of school-age children (Purohit et al., 2023).

In addition to this, this study has broader applications in the field of physical education and martial arts education. The rope limiter can be used as an affordable, scalable, and easily adaptable form of instructional aid, which can be introduced in schools lacking proper infrastructure. In the context of international education systems, the use of safe training aids may foster inclusivity in sports and lower risks of injuries amongst novice students (Ghaderi et al., 2021). Lastly, future investigations are recommended to conduct an evaluation of motor retention that follows rope limiter treatment. Testing for retention carried out several weeks or months following the training would enable the determination of whether the noted benefits were due to transient performance adaptation or motor memory retention. Future studies are further recommended to use larger sample sizes, along with biomechanical motion analysis and improved motion assessment measures.

CONCLUSION

This research found that targeted training using a rope limiter and regular training using a chair were effective in enhancing T-kick precision among elementary school learners. The Wilcoxon test revealed that there was an improvement in T-kick precision among the two groups ($p < 0.001$). This shows that there was an enhancement in motor skill learning through targeted training within the intervention process. In addition, the Mann-Whitney test revealed the functionality of equivalency among the two types of media. The results of the current research make significant contributions to the progress made in physical education and martial arts pedagogy through the confirmation that a certain training media can be used both for improving the skills and preventing injuries at the beginner level of study. Rope limiter media were found to be not only more effective means of teaching martial arts than any other media because they ensure a higher level of safety, but also a way to overcome the safety-performance contradiction common to martial arts practice, especially among elementary school children.

The rope limiter is also practical since it is easy to implement at a low cost by schools lacking sports facilities and equipment. Consequently, physical education teachers and martial arts trainers are recommended to employ adaptable training media that can ensure accuracy in

movements without causing injuries during training. Adaptable training media such as the rope limiter could create an inclusive environment for learning children. However, despite its favorable results, this study also has some drawbacks. For example, the program was carried out for only a short period of time and had a small number of participants of certain age groups. It is thus advised that future researches be conducted on retention tests after rope limiter training programs to test the stability of motor memory formation. In addition, it is also suggested that future researches be done using larger sample size and biomechanical movement assessment of participants to enhance scientific validity.

BIBLIOGRAPHY

- An, J., & Wulf, G. (2024). Golf skill learning: An external focus of attention enhances performance and motivation. *Psychology of Sport and Exercise*, 70, 102563. <https://doi.org/10.1016/j.psychsport.2023.102563>
- Azzarito, M., Emmenegger, T. M., Ziegler, G., Huber, E., Grabher, P., Callaghan, M. F., Thompson, A., Friston, K., Weiskopf, N., Killeen, T., & Freund, P. (2023). Coherent, time-shifted patterns of microstructural plasticity during motor-skill learning. *NeuroImage*, 274, 120128. <https://doi.org/10.1016/j.neuroimage.2023.120128>
- Barnett, L. M., Webster, E. K., Hultheen, R. M., De Meester, A., Valentini, N. C., Lenoir, M., Pesce, C., Getchell, N., Lopes, V. P., Robinson, L. E., Brian, A., & Rodrigues, L. P. (2022). Through the Looking Glass: A Systematic Review of Longitudinal Evidence, Providing New Insight for Motor Competence and Health. In *Sports Medicine* (Vol. 52, Number 4). Springer International Publishing. <https://doi.org/10.1007/s40279-021-01516-8>
- Bhatt, T., Dusane, S., Gangwani, R., Wang, S., & Kannan, L. (2023). Motor adaptation and immediate retention to overground gait-slip perturbation training in people with chronic stroke: an experimental trial with a comparison group. *Frontiers in Sports and Active Living*, 5(September), 1–17. <https://doi.org/10.3389/fspor.2023.1195773>
- Blomqvist Mickelsson, T., & Stylin, P. (2021). Integrating Rough-and-Tumble Play in Martial Arts: A Practitioner's Model. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.731000>
- Chen, H., Liu, J., Li, Y., Zheng, S., Jia, Z., Xu, Y., Zhu, W., Liu, Y., Ji, Y., Shen, Y., & Zheng, M. (2026). Exercise-induced neuroplasticity: Molecular mechanisms and implications for cognitive health and disease intervention. *Journal of Human Sport and Exercise*, 21(2), 391–406. <https://www.jhse.es/index.php/jhse/article/view/exercise-enhances-neuroplasticity-supporting-cognitive-health>
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Dimas Abdulrahman, Edi Purnomo, R. P. P. (2021). Pengaruh Media Latihan Terhadap Peningkatan Teknik Dasar Tendangan Sabit Pada Cabang Olahraga Pencak Silat. *Jurnal.Untan.Ac.Id*, 10. <https://jurnal.untan.ac.id/index.php/jpdpb/article/view/50303>
- Forero, J., Vette, A. H., & Hebert, J. S. (2023). Technology-based balance performance assessment can eliminate floor and ceiling effects. *Scientific Reports*, 13(1), 1–11. <https://doi.org/10.1038/s41598-023-41671-8>

- Ghaderi, M., Letafatkar, A., Thomas, A. C., & Keyhani, S. (2021). Effects of a neuromuscular training program using external focus attention cues in male athletes with anterior cruciate ligament reconstruction: a randomized clinical trial. *BMC Sports Science, Medicine and Rehabilitation*, 13(1), 49. <https://doi.org/10.1186/s13102-021-00275-3>
- Grgic, J., Mikulic, I., & Mikulic, P. (2021). Acute and Long-Term Effects of Attentional Focus Strategies on Muscular Strength: A Meta-Analysis. *Sports*, 9(11), 153. <https://doi.org/10.3390/sports9110153>
- Heuvelmans, P., Di Paolo, S., Benjaminse, A., Bragonzoni, L., & Gokeler, A. (2024). Relationships Between Task Constraints, Visual Constraints, Joint Coordination and Football-Specific Performance in Talented Youth Athletes: An Ecological Dynamics Approach. *Perceptual and Motor Skills*, 131(1), 161–176. <https://doi.org/10.1177/00315125231213124>
- Info, A. (2021). Unnes Journal of Sport Sciences ANALISIS GERAK TENDANGAN T PENCAK SILAT PADA ATLET PERGURUAN TAPAK SUCI MIJEN SEMARANG. *Unnes Journal of Sport Sciences*, 5(2), 92–100. <https://journal.unnes.ac.id/sju/index.php/ujss/article/view/49987%0Ahttps://journal.unnes.ac.id/sju/index.php/ujss/article/download/49987/20179>
- Kim, H., Park, K. H., & Park, S. (2021). Gender differences in sexual behaviors and their relevance to mental health among high school students with sexual experience in South Korea. *International Journal of Environmental Research and Public Health*, 18(21). <https://doi.org/10.3390/ijerph182111295>
- Kirk, C., Langan-Evans, C., Clark, D. R., & Morton, J. P. (2024). The Relationships Between External and Internal Training Loads in Mixed Martial Arts. *International Journal of Sports Physiology and Performance*, 19(2), 173–184. <https://doi.org/10.1123/ijsp.2023-0037>
- Kweon, J., Vigne, M. M., Jones, R. N., Carpenter, L. L., & Brown, J. C. (2023). Practice makes plasticity: 10-Hz rTMS enhances LTP-like plasticity in musicians and athletes. *Frontiers in Neural Circuits*, 17. <https://doi.org/10.3389/fncir.2023.1124221>
- Messer, D. J., Williams, M. D., Bourne, M. N., Opar, D. A., Timmins, R. G., & Shield, A. J. (2022). Anterior Cruciate Ligament Reconstruction Increases the Risk of Hamstring Strain Injury Across Football Codes in Australia. *Sports Medicine*, 52(4), 923–932. <https://doi.org/10.1007/s40279-021-01567-x>
- Mohammadi Sanjani, F., Kamp, J., Bahram, A., & Savelsbergh, G. (2023). *Effect of internal, external, and holistic focus of attention on punching performance with preferred and non-preferred hand*. <https://doi.org/10.13140/RG.2.2.11630.38725>.
- Mulloney, B., Smarandache-Wellmann, C., Weller, C., Hall, W. M., & DiCaprio, R. A. (2014). *Proprioceptive feedback modulates coordinating information in a system of segmentally-distributed microcircuits*. <https://doi.org/https://doi.org/10.48550/arXiv.1407.3249>
- Park, J., & Jeong, J. (2023). Dribble accuracy and arm coordination pattern according to motor expertise and tempo. *International Journal of Environmental Research and Public Health*, 20(10), 5788.

- Purohit, R., Wang, S., & Bhatt, T. (2023). Effect of Aging and Cortical Stroke on Motor Adaptation to Overground Gait-Slips: Quantifying Differences in Adaptation Rate and Adaptation Plateau. *Biomechanics (Switzerland)*, 3(1), 29–44. <https://doi.org/10.3390/biomechanics3010003>
- Ramamoorthy, N., Jamieson, O., Imaan, N., Plaisted-Grant, K., & Davis, G. (2021). Enhanced detection of gaze toward an object: Sociocognitive influences on visual search. *Psychonomic Bulletin and Review*, 28(2), 494–502. <https://doi.org/10.3758/s13423-020-01841-5>
- Satria, G. S., Subarjah, H., & Indra Safari. (2022). The effect of training methods and motivation on the mastering of pencak silat single category. *Gladi : Jurnal Ilmu Keolahragaan*, 13(1), 88–97. <https://doi.org/10.21009/gjik.131.08>
- Tassignon, B., Verschueren, J., Baeyens, J.-P., Benjaminse, A., Gokeler, A., Serrien, B., & Clijsen, R. (2021). An Exploratory Meta-Analytic Review on the Empirical Evidence of Differential Learning as an Enhanced Motor Learning Method. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.533033>
- UNESCO. (2019). *Traditions of Pencak Silat*. UNESCO.
- Virghani, G. A., Nurkholis, M., & Lusianti, S. (2025). Analisis Cedera Pada Atlet Pencak Silat Kelas Dewasa. *Jurnal Edukasi Citra Olahraga*, 5(2), 208–218. <https://doi.org/10.38048/jor.v5i2.5434>
- Wąsik, J., Mosler, D., Ortenburger, D., & Góra, T. (2021). Stereophotogrammetry measurement of kinematic target effect as speed accuracy benchmark indicator for kicking performance in martial arts. *Acta of Bioengineering and Biomechanics*, 23(4). <https://doi.org/10.37190/ABB-01926-2021-06>