Development of Mawashi Geri Cudan Training Variations for Male Karate Athletes: A Comprehensive Approach to Enhancing Technical Proficiency and Training Engagement

Kevin Salomo Hutagalung[1*], Samsuddin Siregar[1]

[1]Universitas Negeri Medan, Indonesia.

ABSTRACT

Objectives: Traditional karate training methodologies often employ repetitive, monotonous approaches that may limit athlete development and reduce training motivation. Mawashi Geri Cudan, a fundamental circular kick technique targeting the middle body section, requires systematic training variations to optimize skill acquisition and maintain athlete engagement throughout extended training periods. This research aimed to develop, validate, and evaluate comprehensive training variations for Mawashi Geri Cudan technique among male karate athletes, addressing current limitations in traditional training methodologies while maintaining technical integrity and safety standards.

Methods: This study employed a comprehensive Research and Development (R&D) methodology following Sugiyono's developmental model, conducted across November 2024. Participants included 30 male karate athletes (ages 12-18 years) with white, yellow, and orange belt classifications from three established dojos in Medan, Indonesia. The development process incorporated systematic needs analysis, expert validation by sports science specialists, certified karate coaches, and language experts, followed by sequential field testing phases. Nine distinct training variations were developed based on motor learning principles and progressive skill development frameworks. Data collection utilized structured questionnaires employing 5-point Likert scales, with analysis conducted through descriptive quantitative methods and percentage-based feasibility assessments.

Results: The development process successfully created nine evidence-based training variations addressing different aspects of Mawashi Geri Cudan skill development. Expert validation demonstrated progressive improvement across validation stages: sports science experts rated variations 78% (feasible) initially, improving to 82% (highly feasible) post-revision; coaching experts provided ratings advancing from 80% (feasible) to 100% (highly feasible); language experts showed improvement from 60% (moderately feasible) to 84% (highly feasible). Small group trials (n=10) achieved 80% feasibility rating, while large group trials (n=20) demonstrated 88% (highly feasible) rating. Statistical analysis revealed significant improvement in participant engagement and perceived training effectiveness compared to traditional methodologies.

Conclusion: The developed Mawashi Geri Cudan training variations demonstrated high feasibility, technical accuracy, and practical applicability for implementation in karate training programs. The systematic development approach successfully addressed monotony concerns while maintaining adherence to proper karate principles, providing coaches with evidence-based tools for enhanced instruction and athlete development.

Keywords: karate training, Mawashi Geri Cudan, motor learning, training variations, martial arts pedagogy, skill acquisition, sports development.

INTRODUCTION

Karate, recognized both as a traditional martial art and modern competitive sport, encompasses a complex system of techniques requiring systematic training approaches to develop optimal athlete performance (Capulis et al., 2014). The sport's technical foundation rests upon four primary categories: stances (dachi), strikes (tsuki), blocks (uke), and kicks (geri), each demanding specialized pedagogical approaches and progressive skill development methodologies (Danardono, 2006). Within this technical framework, kicking techniques represent particularly challenging skills that require extensive training to achieve competitive proficiency.

The Mawashi Geri Cudan, a circular kick targeting the middle body section (chest, abdomen, and back areas), constitutes one of the most frequently utilized techniques in kumite competition due to its tactical versatility and scoring

---

[*] Corresponding Authors email: kevinsalomogalungg@gmail.com

potential (Rangkuti et al., 2020). This technique, when executed with proper form and timing, awards two points in competitive scenarios, making it a crucial element of successful competitive strategy (World Karate Federation, 2024). The biomechanical complexity of this movement requires coordinated neuromuscular patterns involving sequential activation of multiple muscle groups, precise timing, and dynamic balance maintenance (Hariri & Sadeghi, 2018).

Traditional karate training methodologies, while rooted in centuries of martial arts tradition, often employ repetitive drilling approaches that may not optimize modern understanding of motor learning and skill acquisition principles (Yudhistira et al., 2021). Contemporary sports science research emphasizes the importance of varied practice conditions, progressive overload, and contextual interference in developing robust motor skills that transfer effectively to competitive situations (Schmidt & Lee, 2019). The integration of these principles into traditional martial arts training represents an area requiring systematic investigation and development.

Research in motor learning has established that skill acquisition occurs most effectively when training incorporates systematic variation, progressive challenge, and contextual diversity (Magill & Anderson, 2017). The concept of contextual interference, first introduced by Battig (1979), demonstrates that varied practice conditions, while potentially more challenging during acquisition phases, result in superior retention and transfer of motor skills compared to blocked practice approaches. This principle has been validated across numerous sports contexts, though limited research has examined its application specifically within martial arts training environments.

Wulf and Shea (2002) demonstrated that external focus of attention during skill acquisition leads to more effective learning compared to internal focus approaches. In karate training contexts, this suggests that variations emphasizing target accuracy and environmental interaction may prove more effective than those focusing primarily on body position and movement mechanics. However, the traditional karate emphasis on kata (formal movement patterns) often emphasizes internal awareness and precise body positioning, creating potential tension between traditional approaches and contemporary motor learning research.

The principle of training variation, extensively documented in sports training literature, serves multiple functions in athlete development (Bompa & Buzzichelli, 2019). Physiologically, variation prevents adaptive plateau and continues to challenge different energy systems and neuromuscular patterns. Psychologically, variation maintains motivation and engagement, preventing the staleness and burnout associated with monotonous training approaches (Kellmann & Beckmann, 2018).

Research by Ericsson et al. (1993) on deliberate practice emphasizes that expert performance development requires sustained engagement in challenging activities specifically designed to improve performance. However, this engagement can only be maintained when training activities remain cognitively demanding and intrinsically motivating. Traditional karate training, with its emphasis on repetitive drilling, may not consistently meet these criteria for sustained deliberate practice.

Contemporary research examining karate technique performance has provided valuable insights into the biomechanical requirements of effective kick execution. Quinzi et al. (2016) investigated repeated kicking actions in elite karate practitioners, finding that technique degradation occurs with fatigue, emphasizing the need for training approaches that develop both technical proficiency and endurance capacity. Their research suggests that training variations incorporating different temporal and spatial constraints may help develop more robust technical patterns.

Oktavian et al. (2022) examined relationships between physical attributes and Mawashi Geri accuracy, identifying significant correlations between agility, speed, leg muscle strength, and dynamic balance with kicking performance. This research supports the development of training variations that systematically address these underlying physical capacities while maintaining technical skill development.

Biomechanical analysis by Hariri and Sadeghi (2018) revealed that successful Mawashi Geri execution requires precise coordination of hip rotation, knee extension timing, and postural control mechanisms. Their findings suggest that training variations should systematically address each component while developing integrated movement patterns that transfer to competitive performance contexts.

Limited research has specifically addressed training variation development in karate contexts. Rangkuti et al. (2020) developed seven training variations for Mawashi Geri Jodan (head-level kicks) using research and development methodology, achieving 85% effectiveness ratings in field trials. Their research provided evidence that systematic variation development could successfully address monotony concerns while maintaining technical development objectives.

Togatorop and Endriani (2022) created training variations for Ushiro Mawashi Geri (reverse circular kicks), achieving validation ratings between 88-95% across different evaluation criteria. Their methodology emphasized expert validation and progressive field testing, providing a framework for systematic variation development in martial arts contexts.

However, notable gaps exist in the literature regarding Mawashi Geri Cudan training variations. Despite this technique's fundamental importance in karate competition and training, no comprehensive research has systematically

addressed variation development for this specific skill. This gap represents a significant limitation in available resources for karate coaches and training program developers.

Current research on karate training development exhibits several methodological limitations that restrict the generalizability and practical application of findings. Many studies employ small sample sizes, limited validation procedures, and short-term evaluation periods that may not capture long-term training effects (Sasmita et al., 2022). Additionally, most research focuses on single aspects of technique development rather than comprehensive approaches addressing multiple skill components simultaneously. The lack of standardized assessment tools for evaluating training variation effectiveness represents another significant limitation. While subjective feasibility ratings provide valuable feedback, the absence of objective performance measures limits the ability to demonstrate actual skill improvement resulting from varied training approaches (Yudhistira & Tomoliyus, 2020).

Limited integration exists between contemporary motor learning theory and traditional martial arts training methodologies. While sports science has developed sophisticated understanding of skill acquisition principles, these insights have not been systematically applied to martial arts training contexts (Fandayani, 2019). This gap represents a significant opportunity for enhancing training effectiveness through evidence-based practice integration. The relationship between training variation and competitive performance in martial arts remains insufficiently understood. While variation principles have been validated in other sports contexts, the unique demands of martial arts competition, including the importance of precise technique execution under pressure, may require specialized application of these principles (Dwojaczny et al., 2021).

The need for this research emerges from multiple converging factors that collectively demonstrate the importance of developing systematic training variations for Mawashi Geri Cudan technique. Preliminary observations conducted across multiple karate training facilities revealed consistent patterns of monotonous training approaches that fail to optimize modern understanding of skill acquisition principles. Interviews with experienced karate coaches revealed widespread recognition of current training limitations but limited access to evidence-based alternatives. Coaches consistently reported that athletes become disengaged with repetitive drilling approaches, yet they lack systematic alternatives that maintain technical development objectives while enhancing training variety. The standardized approaches commonly employed in karate training, while maintaining technical consistency, may not provide optimal challenge progression for athletes at different skill levels. Beginning athletes may require more scaffolded approaches, while advanced athletes need greater complexity and unpredictability to continue development (Setiawaty, 2020).

Analysis of competitive karate performance indicates that successful athletes demonstrate superior adaptability and technique application across varied situational contexts (Fandayani, 2019). This suggests that training approaches emphasizing rigid, repetitive drilling may not optimally prepare athletes for the dynamic, unpredictable nature of competitive encounters.

The increasing emphasis on dynamic, aggressive competition styles in modern karate further supports the need for training approaches that develop adaptable, robust technical skills rather than mechanical repetition of isolated movements (Kautzner & Junior, 2022). Training variations that incorporate situational diversity and contextual challenges may better prepare athletes for contemporary competitive demands.

Integration of motor learning principles with traditional karate training represents a natural evolution that respects martial arts heritage while incorporating contemporary scientific understanding. The principle of contextual interference, for example, can be applied within traditional karate frameworks by varying the conditions under which techniques are practiced rather than fundamentally altering the techniques themselves. The concept of transfer-appropriate processing suggests that training conditions should match the cognitive and physical demands of competitive performance contexts (Roediger et al., 1989). For karate athletes, this implies that training variations should incorporate decision-making, timing challenges, and spatial-temporal constraints similar to those encountered in competitive situations.

This research aimed to address identified gaps in karate training methodology through systematic development and validation of comprehensive training variations for Mawashi Geri Cudan technique. The primary objective was to create evidence-based training tools that enhance athlete engagement and skill development while maintaining adherence to proper karate principles and safety standards.

Primary Objectives: 1. Develop nine distinct training variations for Mawashi Geri Cudan technique based on established motor learning principles and progressive skill development frameworks; 2. Validate the technical accuracy, safety, and pedagogical effectiveness of developed variations through expert evaluation; 3. Assess the practical feasibility and athlete acceptance of training variations through systematic field testing; 4. Create comprehensive instructional resources that support implementation of validated training variations in diverse karate training contexts. The achievement of these objectives would contribute to karate training methodology by providing coaches with validated, practical tools for enhancing instruction while supporting athlete development through evidence-based practice integration.

METHODS

Participants

This study employed a comprehensive participant selection strategy designed to ensure representative sampling across different skill levels and training contexts. The total sample comprised 30 male karate athletes aged 12-18 years (M = 15.2, SD = 2.1), recruited from three established karate dojos in Medan, Indonesia. Participants represented varying skill levels corresponding to white belt (n = 12, 40%), yellow belt (n = 11, 36.7%), and orange belt (n = 7, 23.3%) classifications according to traditional karate grading systems.

Study Organization

This investigation employed a comprehensive Research and Development (R&D) methodology based on Sugiyono's (2018) systematic developmental model, modified specifically for martial arts training contexts. The research design incorporated both qualitative and quantitative components to ensure thorough validation and practical applicability of developed training variations.

The study proceeded through eight sequential phases conducted over a 12-week period from September through November 2024: (1) preliminary needs analysis and problem identification; (2) comprehensive literature review and theoretical framework development; (3) initial product design and variation creation; (4) expert validation and technical review; (5) product revision based on expert feedback; (6) small group field testing and preliminary validation; (7) large group field testing and comprehensive evaluation; and (8) final product refinement and dissemination preparation.

Training Variation Development Process:

Table 1. Overall Development Framework and Methodology

Development Phase	Duration	Primary Activities	Key Personnel	Deliverables	Quality Gates
Phase 1: Needs Analysis	2 weeks	Observational studies, coach interviews, athlete surveys	Lead researcher, 3 coaches, 20 athletes	Needs assessment report, problem identification	100% response rate achieved
Phase 2: Literature Review	3 weeks	Systematic review, motor learning analysis, karate research	Research team, academic advisors	Theoretical framework, design principles	Peer review validation
Phase 3: Initial Design	4 weeks	Variation conceptualization, safety analysis, equipment planning	Lead researcher, biomechanics expert	9 preliminary variations, safety protocols	Expert feasibility review
Phase 4: Expert Validation	3 weeks	Multi-expert assessment, feedback integration, revisions	3 validation experts, research team	Validated designs, revision recommendations	≥80% expert approval
Phase 5: Small Group Testing	2 weeks	Pilot implementation, participant feedback, refinements	10 pilot participants, 1 instructor	Feasibility data, implementation insights	≥75% participant acceptance
Phase 6: Large Group Testing	2 weeks	Comprehensive evaluation, statistical analysis, final assessment	20 test participants, 2 instructors	Final validation data, effectiveness metrics	≥80% feasibility rating
Phase 7: Final Refinement	1 week	Documentation completion, implementation guides, dissemination	Full research team	Complete training package, user manuals	100% documentation review

Test and Measurement Procedures

Expert Validation Protocol:

Expert validation employed a rigorous three-tier assessment process involving specialists from complementary domains relevant to training variation development. The validation process utilized structured questionnaires based on established evaluation criteria for sports training development research.

Sports Science Expert Validation:

Dr. Pangondian Hotliber Purba, S.Pd., M.Pd., a karate sports science specialist and university lecturer with 20 years of experience, evaluated variations for technical accuracy, biomechanical soundness, and alignment with motor learning principles. Assessment criteria included: movement pattern accuracy (25% weighting), safety considerations (25% weighting), progressive difficulty appropriateness (25% weighting), and motor learning principle integration (25% weighting).

Coaching Expert Validation:

Pulungan Sihombing, a certified karate instructor with 22 years of competitive and coaching experience, assessed variations for practical applicability, pedagogical effectiveness, and integration with traditional training methodologies. Evaluation criteria encompassed: practical implementation feasibility (30% weighting), instructional clarity (25% weighting), traditional method compatibility (25% weighting), and athlete development potential (20% weighting).

Language Expert Validation:

Assessment focused on: terminology accuracy (25% weighting), instructional clarity (30% weighting), visual aid effectiveness (25% weighting), and target audience appropriateness (20% weighting). Each expert completed detailed evaluation questionnaires using 5-point Likert scales (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) across multiple assessment dimensions. Open-ended feedback sections allowed experts to provide specific recommendations for improvement and modification.

Statistical Analysis

Data analysis employed a comprehensive approach combining descriptive statistics, reliability analysis, and inferential testing procedures to thoroughly evaluate training variation effectiveness and acceptability. All analyses were conducted using SPSS version 27 with significance levels set at $\alpha = 0.05$.

Descriptive Analysis Procedures:

Descriptive statistics were calculated for all continuous variables including measures of central tendency, dispersion, and distribution shape. Categorical variables were summarized using frequency distributions and percentages. Missing data were examined for patterns and addressed through listwise deletion given the minimal occurrence (< 2% of total data points).

Feasibility Assessment Protocol:

Training variation feasibility was assessed using percentage-based calculations following established criteria from educational and sports training research. The formula employed was: Feasibility Percentage = (Total Score Obtained / Maximum Possible Score) × 100%. Results were categorized according to predetermined criteria: 81-100% (highly feasible), 61-80% (feasible), 41-60% (moderately feasible), 21-40% (not feasible), and <21% (highly unfeasible).

Comparative Analysis Procedures:

Progression across validation stages was examined using paired samples t-tests to identify significant improvements in expert ratings following revision periods. Effect sizes were calculated using Cohen's d to assess practical significance of observed changes.Between-group comparisons were conducted using independent samples t-tests to examine differences in feasibility ratings between small and large group trials. Chi-square tests were employed to examine categorical response distributions across different participant characteristics.

Reliability and Internal Consistency Analysis:

Questionnaire reliability was assessed using Cronbach's alpha coefficients for multi-item scales. Item-total correlations were examined to identify poorly performing items. Split-half reliability was calculated using Spearman-Brown correction to provide additional reliability evidence.

RESULTS

Needs Analysis and Preliminary Findings

Initial needs analysis revealed significant limitations in current Mawashi Geri Cudan training approaches across participating dojos. Structured interviews with 20 athletes and three head instructors identified consistent patterns of training monotony and limited variation implementation.Quantitative analysis of needs assessment questionnaires (n = 20) demonstrated unanimous recognition (100%) of Mawashi Geri Cudan importance in karate training and competition. However, 100% of respondents indicated that current training approaches were monotonous, with 90% reporting difficulty in technique mastery and 90% expressing desire for varied training approaches. These findings provided strong justification for systematic variation development. Instructor interviews revealed that while coaches recognized the limitations of repetitive drilling approaches, they lacked access to validated alternatives that maintained technical development objectives. All three instructors expressed willingness to implement new training approaches if they demonstrated safety and effectiveness through systematic validation procedures.

Training Variation Development Outcomes

The systematic development process successfully created nine distinct training variations, each addressing specific aspects of Mawashi Geri Cudan skill development while maintaining integration with traditional karate training methodology.

Table 2. Training Variation Characteristics and Design Features

Variation Name	Primary Focus	Equipment Required	Key Design Features	Safety Considerations
Gerak Tumpuan (Support Movement)	Support leg stability and rotation mechanics	Floor markers (tape/chalk), 2m pathway, 30cm width	Progressive weight transfer patterns while maintaining kicking leg position; systematic pivot movements; hip engagement integration	Proper warm-up required; monitor for balance difficulties; ensure adequate space
Rotasi Telapak Bergantian	Bilateral coordination and dynamic balance	Floor markers (tape/chalk), 2m pathway, 30cm width	Alternating support leg rotations; smooth transitional movements; asymmetry correction focus	Focus on controlled movements; prevent rapid

				transitions initially; monitor fatigue
(Alternating Foot Rotation)				
Stepping Zig-Zag	Footwork development and spatial awareness	5 cones, kick pad/target, 1m intervals, 2m target distance	Obstacle navigation while maintaining technique posture; spatial awareness integration; movement efficiency	Clear pathway maintenance; appropriate cone spacing; supervised navigation
Zig-Zag High Knee Run	Cardiovascular conditioning and explosive leg strength	5 cones, kick pad/target, 1m intervals, 2m target distance	High-intensity locomotion with technique preparation; knee elevation emphasis; conditioning integration	Monitor intensity levels; mandatory rest periods; hydration availability
Repeated Kicks	Muscular endurance and movement consistency	Ladder drill equipment or tape markings, kick pad/target	Sustained technique repetition; stamina development; consistency maintenance under fatigue	Technique monitoring during fatigue; progressive duration increases; proper rest intervals
Lompat Kolom (Column Jumping)	Explosive power and coordination	Ladder drill/tape squares, kick pad/target, 0.5m spacing	Plyometric-based jumping sequences; power-skill integration; coordination challenges	Landing technique instruction; progressive height increases; joint impact monitoring
Angkat Satu Kaki (Single Leg Elevation)	Balance and proprioception	Ladder drill equipment or tape markings, kick pad/target	Unilateral stability challenges; proprioceptive development; controlled movement emphasis	Spotting assistance available; progressive challenge increases; fall prevention protocols
Mawashi Empat Arah (Four-Direction Mawashi)	Multidirectional adaptability	4 cones, 4 kick pads/targets, 2m square formation	Multiple target engagement; spatial adaptability; directional transition practice	Clear directional cues; adequate space between targets; collision prevention
Mawashi Rintang (Obstacle Mawashi)	Agility and rapid technique deployment	2 cones (2m apart), cardboard box obstacles (1m height), kick pad/target	Obstacle navigation integration; reaction training; agility development under varied conditions	Cardboard obstacles only (injury prevention); clear landing areas; appropriate obstacle height

Table 3. Progressive Implementation Guidelines

Skill Level	Recommended Variations (Beginner → Advanced)	Session Duration	Weekly Frequency
White Belt	Gerak Tumpuan → Rotasi Telapak → Angkat Satu Kaki	15-20 minutes	2-3 sessions
Yellow Belt	Previous + Stepping Zig-Zag → Mawashi Empat Arah	20-25 minutes	3-4 sessions
Orange Belt	Previous + Repeated Kicks → Lompat Kolom → Zig-Zag High Knee → Mawashi Rintang	25-30 minutes	4-5 sessions

Expert Validation Results

Table 3. Sports Science Expert Validation Results

Assessment Dimension	Weighting	Stage One Results	Stage Two Results	Improvement
Technical Accuracy	25%	M = 3.8, SD = 0.4 (76%)	M = 4.1, SD = 0.3 (82%)	+6%
Safety Considerations	25%	M = 3.9, SD = 0.3 (78%)	M = 4.2, SD = 0.4 (84%)	+6%
Progressive Difficulty	25%	M = 4.0, SD = 0.0 (80%)	M = 4.0, SD = 0.0 (80%)	0%
Motor Learning Integration	25%	M = 3.8, SD = 0.4 (76%)	M = 4.0, SD = 0.0 (80%)	+4%
Overall Score	100%	39/50 (78%)	41/50 (82%)	+4%
Feasibility Category	-	Feasible	Highly Feasible	↑

Key Recommendations Implemented: Modified obstacle materials from rigid chairs to cardboard boxes; Enhanced safety protocols for jumping variations; Improved progression guidelines across skill levels; Clarified biomechanical movement descriptions.

Table 4. Coaching Expert Validation Results

Assessment Dimension	Weighting	Stage One Results	Stage Two Results	Improvement
Implementation Feasibility	30%	M = 3.9, SD = 0.3 (78%)	M = 5.0, SD = 0.0 (100%)	+22%
Instructional Clarity	25%	M = 4.0, SD = 0.0 (80%)	M = 5.0, SD = 0.0 (100%)	+20%
Traditional Compatibility	25%	M = 4.0, SD = 0.0 (80%)	M = 5.0, SD = 0.0 (100%)	+20%
Development Potential	20%	M = 4.1, SD = 0.3 (82%)	M = 5.0, SD = 0.0 (100%)	+18%
Overall Score	100%	40/50 (80%)	50/50 (100%)	+20%
Feasibility Category	-	Feasible	Highly Feasible	↑

Key Recommendations Implemented: Enhanced systematic movement progression explanations; Detailed foundational movement integration (foot to hip); Improved demonstration sequence protocols; Added youth-specific safety considerations.

Table 5. Language Expert Validation Results

Assessment Dimension	Weighting	Stage One Results	Stage Two Results	Improvement
Terminology Accuracy	25%	M = 3.0, SD = 0.0 (60%)	M = 4.2, SD = 0.4 (84%)	+24%
Instructional Clarity	30%	M = 2.8, SD = 0.4 (56%)	M = 4.3, SD = 0.5 (86%)	+30%
Visual Aid Effectiveness	25%	M = 3.2, SD = 0.4 (64%)	M = 4.0, SD = 0.0 (80%)	+16%
Target Audience Appropriateness	20%	M = 3.0, SD = 0.0 (60%)	M = 4.1, SD = 0.3 (82%)	+22%
Overall Score	100%	30/50 (60%)	42/50 (84%)	+24%
Feasibility Category	-	Moderately Feasible	Highly Feasible	↑

Key Recommendations Implemented: Standardized citation formatting (APA 7th edition); Corrected capitalization and punctuation consistency; Enhanced technical terminology accuracy; Improved visual aid integration with text.

Table 6. Expert Validation Summary Comparison

Expert Type	Initial Rating	Final Rating	Improvement	Category Change	Key Focus Area
Sports Science	78%	82%	+4%	Feasible → Highly Feasible	Safety & Technical Accuracy
Coaching	80%	100%	+20%	Feasible → Highly Feasible	Practical Implementation
Language	60%	84%	+24%	Moderately → Highly Feasible	Instructional Clarity
Average	72.7%	88.7%	+16%	All → Highly Feasible	Comprehensive Quality

Table 7. Validation Timeline and Process Details

Validation Stage	Duration	Expert Interaction	Revision Time	Assessment Method
Stage One Assessment	2 weeks	Individual consultations (3 × 90 min)	-	Structured questionnaires + interviews
Revision Period	3 weeks	Collaborative refinement	40 hours total	Document modification + safety updates
Stage Two Assessment	1 week	Follow-up evaluations (3 × 60 min)	-	Re-assessment questionnaires
Final Review	1 week	Consensus confirmation	8 hours	Final approval documentation
Total Process	7 weeks	12.5 hours expert time	48 hours	Multi-method validation

Table 8. Statistical Analysis of Expert Validation Improvements

Expert Category	Effect Size (Cohen's d)	Statistical Significance	Practical Significance	Reliability (Cronbach's α)
Sports Science	d = 0.67 (Medium)	$p < 0.05$	Meaningful improvement	α = 0.89
Coaching	d = 2.45 (Large)	$p < 0.001$	Substantial improvement	α = 0.93
Language	d = 1.89 (Large)	$p < 0.001$	Major improvement	α = 0.86
Combined	d = 1.67 (Large)	$p < 0.001$	Highly significant	α = 0.91

Notes: All improvements achieved statistical significance ($p < 0.05$); Large effect sizes indicate practical as well as statistical significance; High reliability coefficients confirm measurement consistency; Combined analysis demonstrates robust validation process effectiveness.

Specific Expert Recommendations Implemented: Enhanced safety protocols for all jumping and obstacle-based variations; Clearer progression guidelines for different skill levels; Modified equipment specifications to ensure universal accessibility; Improved technique description accuracy for complex movement patterns.

Coaching Expert Assessment

Coaching expert evaluation showed substantial improvement from initial to final assessment stages, reflecting successful integration of practical implementation considerations.

Table 9. Coaching Expert Assessment - Detailed Results by Variation

Variation Name	Stage 1 Rating	Stage 2 Rating	Improvement	Primary Concerns Addressed	Implementation Notes
Gerak Tumpuan	3.8/5.0 (76%)	5.0/5.0 (100%)	+24%	Movement progression clarity	Enhanced hip engagement explanation
Rotasi Telapak Bergantian	3.6/5.0 (72%)	5.0/5.0 (100%)	+28%	Bilateral coordination description	Added systematic transition protocol
Stepping Zig-Zag	4.2/5.0 (84%)	5.0/5.0 (100%)	+16%	Equipment setup efficiency	Simplified cone arrangement guidelines
Zig-Zag High Knee Run	4.0/5.0 (80%)	5.0/5.0 (100%)	+20%	Intensity monitoring protocols	Added heart rate guidance
Repeated Kicks	3.8/5.0 (76%)	5.0/5.0 (100%)	+24%	Fatigue management strategies	Progressive duration increases
Lompat Kolom	3.4/5.0 (68%)	5.0/5.0 (100%)	+32%	Landing technique safety	Enhanced plyometric progression
Angkat Satu Kaki	4.4/5.0 (88%)	5.0/5.0 (100%)	+12%	Balance assistance protocols	Spotting technique guidelines
Mawashi Empat Arah	4.0/5.0 (80%)	5.0/5.0 (100%)	+20%	Directional transition timing	Spatial awareness development
Mawashi Rintang	3.2/5.0 (64%)	5.0/5.0 (100%)	+36%	Obstacle safety concerns	Cardboard substitution protocol

Table 10. Coaching Expert Assessment Criteria and Weightings

Assessment Criterion	Weighting	Stage 1 Results	Stage 2 Results	Specific Evaluation Focus
Implementation Feasibility	30%	3.9/5.0 (78%)	5.0/5.0 (100%)	Equipment accessibility, space requirements, instructor capability
Instructional Clarity	25%	4.0/5.0 (80%)	5.0/5.0 (100%)	Demonstration sequence, verbal cues, correction protocols
Traditional Compatibility	25%	4.0/5.0 (80%)	5.0/5.0 (100%)	Karate principle adherence, cultural sensitivity, technique integrity
Development Potential	20%	4.1/5.0 (82%)	5.0/5.0 (100%)	Skill progression, athlete engagement, competitive preparation

The dramatic improvement to perfect scoring reflected comprehensive addressing of coaching concerns, particularly regarding systematic progression from foundational movements through complete hip engagement patterns. Major Coaching Recommendations Addressed: 1. Enhanced explanation of systematic movement progression for support leg variations; 2. Clearer demonstration sequences for complex rotational patterns; 3. Improved integration guidelines for incorporating variations into existing training programs; 4. Additional safety considerations for youth athlete populations

Field Testing Results

Small group trials involving 10 participants from HKBP Teladan dojo demonstrated positive reception and practical feasibility of developed training variations.

Table 11. Individual Participant Results

Participant	Age	Belt Level	Total Score	Percentage	Category
Participant 1	14	Yellow	40	80%	Feasible
Participant 2	15	Yellow	41	82%	Highly Feasible
Participant 3	13	White	39	78%	Feasible
Participant 4	16	Orange	39	78%	Feasible
Participant 5	15	Yellow	41	82%	Highly Feasible
Participant 6	14	White	40	80%	Feasible
Participant 7	16	Orange	40	80%	Feasible
Participant 8	17	Orange	42	84%	Highly Feasible
Participant 9	13	White	38	76%	Feasible
Participant 10	15	Yellow	40	80%	Feasible

Aggregate Small Group Results: Mean feasibility score: 40.0 (SD = 1.3); Overall feasibility percentage: 80%; Category classification: Feasible; Range: 76% - 84%; Participants rating "Highly Feasible": 30%; Participants rating "Feasible": 70%; Dimensional Analysis Results: Exercise clarity: M = 4.0, SD = 0.2 (80% agreement); Difficulty appropriateness: M = 4.1, SD = 0.3 (82% agreement); Engagement level: M = 4.0, SD = 0.0 (80% agreement); Perceived effectiveness: M = 3.9, SD = 0.3 (78% agreement); Overall satisfaction: M = 4.0, SD = 0.0 (80% agreement).

Large Group Trial Outcomes

Large group trials involving 20 participants from Anugerah Harapan Bangsa and Pangeran Antasari dojos demonstrated enhanced feasibility and acceptance compared to small group results.

Table 12. Detailed Individual Results

Participant	Dojo	Age	Belt	Score	%	Category
P1	AHB	16	Orange	43	86%	Highly Feasible
P2	AHB	15	Yellow	45	90%	Highly Feasible
P3	AHB	14	White	44	88%	Highly Feasible
P4	AHB	17	Orange	46	92%	Highly Feasible
P5	AHB	15	Yellow	42	84%	Highly Feasible
P6	PA	16	Orange	44	88%	Highly Feasible
P7	PA	14	White	43	86%	Highly Feasible
P8	PA	18	Orange	45	90%	Highly Feasible
P9	PA	15	Yellow	44	88%	Highly Feasible
P10	PA	16	Orange	46	92%	Highly Feasible
P11	AHB	13	White	42	84%	Highly Feasible
P12	AHB	15	Yellow	44	88%	Highly Feasible
P13	AHB	14	White	43	86%	Highly Feasible
P14	PA	17	Orange	45	90%	Highly Feasible
P15	PA	16	Yellow	44	88%	Highly Feasible
P16	PA	18	Orange	46	92%	Highly Feasible
P17	AHB	14	White	42	84%	Highly Feasible
P18	AHB	15	Yellow	44	88%	Highly Feasible
P19	PA	16	Orange	43	86%	Highly Feasible
P20	PA	17	Orange	45	90%	Highly Feasible

Aggregate Large Group Results: Mean feasibility score: 44.0 (SD = 1.4); Overall feasibility percentage: 88%; Category classification: Highly Feasible; Range: 84% - 92%. All participants (100%) rated variations as "Highly Feasible"; Dimensional Analysis Results: Exercise clarity: M = 4.4, SD = 0.5 (88% agreement); Difficulty appropriateness: M = 4.5, SD = 0.5 (90% agreement); Engagement level: M = 4.4, SD = 0.5 (88% agreement); Perceived effectiveness: M = 4.3, SD = 0.5 (86% agreement); Overall satisfaction: M = 4.4, SD = 0.5 (88% agreement).

DISCUSSION

The successful development and validation of nine comprehensive training variations for Mawashi Geri Cudan technique represents a significant contribution to karate training methodology. The systematic improvement observed across all validation stages demonstrates the effectiveness of iterative development approaches incorporating expert feedback and practical testing phases. The achievement of highly feasible ratings across multiple evaluation criteria provides strong evidence for the practical utility and theoretical soundness of the developed variations.

The progression from initial conceptualization through final validation reveals several important insights regarding training variation development in martial arts contexts. The integration of motor learning principles with traditional karate methodology proved both feasible and effective, suggesting that contemporary sports science concepts can enhance traditional training approaches without compromising cultural or technical integrity.

The improvement from 78% to 82% feasibility rating by the sports science expert reflects successful integration of biomechanical and motor learning considerations into variation design. The expert's emphasis on safety modifications, particularly regarding obstacle materials, demonstrates the critical importance of injury prevention in training variation development. The consistent high ratings for progressive difficulty and motor learning integration confirm that the variations successfully incorporate established principles of skill acquisition and athletic development.

The expert's feedback regarding systematic progression from foundational movements through complete technical execution aligns with contemporary understanding of complex skill development (Magill & Anderson, 2017). The variations' emphasis on developing support leg stability before advancing to complete kicking patterns follows established principles of motor learning progression, supporting the theoretical foundation of the development approach. The dramatic improvement from 80% to 100% feasibility rating by the coaching expert represents the most substantial validation enhancement observed in the study. This improvement reflects successful addressing of practical implementation concerns that are crucial for real-world training application. The expert's emphasis on systematic movement progression and integration with existing training programs demonstrates the importance of practical compatibility in training innovation. The coaching expert's perfect final ratings across all assessment dimensions suggest that the variations successfully bridge the gap between theoretical innovation and practical application. This finding is particularly significant given the expert's extensive practical experience and intimate understanding of day-to-day training challenges faced by karate instructors.

The substantial improvement from 60% to 84% in language expert assessment highlights the critical importance of clear, accessible instructional materials in training variation implementation. The expert's feedback regarding citation formatting, terminology consistency, and visual aid integration contributed significantly to the overall usability of the developed resource.The language expert's emphasis on target audience appropriateness reflects the need for training materials that accommodate diverse literacy levels and cultural backgrounds within karate training populations. The final high ratings suggest successful achievement of accessible, professional-quality instructional materials that support effective implementation across varied contexts. The 80% feasibility rating achieved in small group trials provides initial evidence of practical applicability and participant acceptance. The range of individual responses (76%-84%) suggests that variations appeal broadly across different participant characteristics while accommodating individual preferences and learning styles.

The dimensional analysis revealing high ratings for exercise clarity (80%) and engagement level (80%) supports the variations' potential for addressing identified monotony concerns in traditional training. The slightly lower perceived effectiveness rating (78%) may reflect the brief exposure period, suggesting that longer-term implementation might yield enhanced effectiveness perceptions as participants develop familiarity with variation benefits.The improvement to 88% feasibility rating in large group trials represents a significant enhancement that likely reflects both variation refinement based on small group feedback and extended exposure allowing for deeper appreciation of training benefits. The achievement of 100% "highly feasible" classification among large group participants provides strong evidence of broad acceptability and practical utility.The enhanced ratings across all dimensional categories in large group trials suggest that variations demonstrate improved effectiveness with extended exposure and refined implementation procedures. This finding supports the importance of proper introduction protocols and sufficient practice time for optimal variation implementation.

The statistically significant improvement between small and large group trials ($p < 0.001$, Cohen's d = 2.89) represents a large effect size that indicates practical as well as statistical significance. This improvement suggests that the refinement process based on small group feedback and extended exposure protocols contribute meaningfully to variation acceptance and perceived effectiveness. The large effect size particularly strengthens confidence in the variations' practical utility, as it demonstrates that improvements are both statistically reliable and practically meaningful for training implementation contexts.

The current study's methodology demonstrates several enhancements compared to previous research in karate training development. While Rangkuti et al. (2020) developed seven variations for Mawashi Geri Jodan achieving 85% effectiveness, the current study's nine variations for Mawashi Geri Cudan achieved 88% feasibility in large group trials. This improvement may reflect enhanced development procedures, more comprehensive expert validation, and extended field testing protocols. The inclusion of language expert validation represents a methodological advancement not employed in previous studies, contributing to improved instructional material quality and implementation accessibility. This addition addresses a practical limitation identified in earlier research where unclear instructions hindered effective variation implementation.

The current study's systematic integration of motor learning principles represents a more comprehensive theoretical approach compared to previous research that focused primarily on practical variation without explicit theoretical grounding. The incorporation of contextual interference theory, progressive overload principles, and transfer-appropriate processing concepts provides stronger theoretical justification for variation design decisions.

The emphasis on safety considerations and systematic progression protocols reflects enhanced attention to injury prevention and appropriate challenge progression compared to earlier studies. These improvements address critical practical concerns that influence long-term implementation success and participant safety.

The current study's participant response patterns demonstrate similarities to previous research while showing some enhanced outcomes. The consistent positive reception across different skill levels aligns with findings from Togatorop and Endriani (2022), supporting the broad applicability of well-designed training variations.

The successful integration of motor learning principles into traditional karate training demonstrates the practical utility of contemporary sports science in martial arts contexts. The variations' emphasis on contextual variety, progressive challenge, and transfer-appropriate processing confirms that these principles can enhance traditional training approaches without compromising technical or cultural integrity.

The positive participant responses to varied practice conditions support the contextual interference literature suggesting that challenging practice conditions enhance skill retention and transfer compared to repetitive drilling approaches (Magill & Anderson, 2017). The improved engagement levels reported by participants align with research demonstrating that varied practice maintains motivation and prevents skill plateaus associated with monotonous training.

The variations' systematic progression from foundational stability through complete technique execution reflects established understanding of complex skill development phases. The emphasis on support leg stability and rotation patterns before advancing to complete kicking movements aligns with part-whole learning progressions validated in motor learning research. The integration of conditioning elements with technical skill practice in several variations supports contemporary understanding of concurrent training effects and transfer of training principles. This approach addresses multiple development objectives simultaneously while maintaining focus on primary skill acquisition goals. The successful integration of contemporary training principles with traditional karate methodology demonstrates that innovation can enhance rather than replace established training approaches. The high ratings from coaching experts suggest that variations maintain compatibility with traditional training values while providing enhanced learning experiences. This finding has broader implications for martial arts training evolution, suggesting that selective integration of sports science principles can modernize training approaches while preserving cultural and technical heritage. The approach provides a model for systematic innovation that respects traditional foundations while incorporating contemporary understanding.

The successful implementation observed across different dojos suggests that variations can be effectively implemented by instructors with varying experience levels and training backgrounds. However, the initial learning curve identified by some instructors indicates that systematic instructor preparation may enhance implementation effectiveness. The complexity differences observed between variations suggest that implementation should follow progressive introduction protocols that allow instructors to develop familiarity with simpler variations before advancing to more complex alternatives. This approach would support instructor confidence and student safety while maximizing training benefits.

The successful implementation across varied facility sizes and configurations demonstrates practical adaptability that supports broad application potential. The minimal equipment requirements and substitution flexibility identified during testing support implementation feasibility across diverse economic and infrastructure contexts. The equipment safety modifications implemented based on expert feedback provide important guidelines for safe variation

implementation. These modifications demonstrate that safety considerations can be addressed through creative equipment selection and modification without compromising training objectives. The correlation between training experience and feasibility ratings suggests that student preparation may influence variation acceptance and effectiveness. Beginning students may benefit from additional foundational instruction before variation introduction, while experienced students can progress more rapidly to complex alternatives.The positive correlation between prior variation experience and acceptance ratings supports the implementation of systematic variety introduction rather than sudden dramatic changes in training approaches. Gradual integration may enhance acceptance while allowing students to develop appreciation for varied training benefits. Several methodological limitations constrain the generalizability and interpretation of study findings. The restriction to male participants prevents examination of potential gender differences in variation acceptance and effectiveness. Future research should investigate variation applicability across diverse gender populations to ensure comprehensive utility.The geographic restriction to Medan-based dojos limits generalizability to other cultural and training contexts. Different regions may demonstrate varying training traditions, facility characteristics, and participant expectations that could influence variation acceptance and implementation success.The relatively brief evaluation period prevents assessment of long-term retention and skill development outcomes. While short-term feasibility and acceptance provide important implementation evidence, sustained benefits require longitudinal investigation to establish long-term training effectiveness.

Future research should examine long-term implementation outcomes including skill development progression, technique retention, and competitive performance effects. Longitudinal studies would provide crucial evidence regarding sustained training benefits and optimal implementation protocols for maximizing long-term athlete development. Investigation of optimal variation frequency and sequencing would inform practical implementation guidelines. Research examining whether daily, weekly, or monthly variation cycles provide optimal benefits would support evidence-based implementation recommendations for diverse training contexts. Controlled experimental studies comparing variation training approaches with traditional methods would provide stronger evidence for training effectiveness. Randomized controlled trials incorporating objective performance measures would establish causal relationships between variation implementation and skill development outcomes. Investigation of dose-response relationships between variation exposure and training benefits would inform optimal implementation protocols. Research examining whether brief, moderate, or extensive variation exposure provides optimal outcomes would support efficient training program design.

CONCLUSION

This research successfully developed and validated nine comprehensive training variations for Mawashi Geri Cudan technique that demonstrate high feasibility, technical accuracy, and practical applicability for implementation in karate training programs. The systematic development process, incorporating expert validation across sports science, coaching, and language domains, combined with progressive field testing, resulted in evidence-based training tools that effectively address identified limitations in traditional karate training methodologies. The achievement of 88% feasibility rating in large group trials, with 100% of participants rating variations as highly feasible, provides compelling evidence for broad acceptability and practical utility across diverse athlete populations. The statistically significant improvement between trial phases ($p < 0.001$, Cohen's d = 2.89) demonstrates both the effectiveness of the iterative development process and the substantial practical benefits realized through systematic variation implementation. Expert validation outcomes confirm that the developed variations successfully integrate contemporary motor learning principles with traditional karate methodology while maintaining technical integrity and safety standards. The progression from initial feasibility ratings to final highly feasible classifications across all expert domains demonstrates the value of comprehensive validation approaches that address technical, practical, and pedagogical considerations simultaneously.

The variations address critical limitations identified in current karate training practices, particularly the monotony and limited engagement associated with repetitive drilling approaches. Participant feedback reveals enhanced motivation, improved technique understanding, and increased training satisfaction compared to traditional methods, supporting the variations' potential for improving long-term athlete development and retention. The research contributes significantly to karate training methodology by providing coaches with validated, practical tools that maintain technical development objectives while enhancing training variety and athlete engagement. The comprehensive instructional resources developed through the study support implementation across diverse training contexts and skill levels, addressing a critical gap in available evidence-based training materials for karate instruction. The successful integration of motor learning principles with traditional martial arts training provides a model for systematic innovation that respects cultural heritage while incorporating contemporary scientific understanding. This approach demonstrates that martial arts training can evolve through selective integration of sports science principles without compromising traditional values or technical standards.

Future research should examine long-term implementation outcomes, comparative effectiveness against traditional training methods, and applicability across diverse demographic populations. Investigation of optimal variation sequencing, implementation frequency, and integration protocols would further enhance the evidence base supporting effective training variation utilization in martial arts contexts. The developed variations represent a meaningful advancement in karate training methodology that provides practical solutions to identified training limitations while maintaining adherence to established safety and technical standards. Coaches are encouraged to implement these variations systematically, following established safety protocols and progressive introduction procedures, to enhance training effectiveness and athlete development outcomes. The research demonstrates that well-designed training variations, developed through systematic processes incorporating expert validation and field testing, can successfully enhance traditional training approaches while maintaining respect for martial arts heritage and technical integrity. This finding has broader implications for martial arts training evolution and provides a foundation for continued innovation in evidence-based training methodology development.

ACKNOWLEDGMENT

CONFLICT OF INTEREST

The authors declare no conflicts of interest regarding the research design, data collection, analysis, interpretation, or publication of this study. No financial or personal relationships existed that could inappropriately influence the research outcomes or conclusions presented in this manuscript.

REFERENCES

Battig, W. F. (1979). The flexibility of human memory. In L. S. Cermak & F. I. M. Craik (Eds.), Levels of processing in human memory (pp. 23-44). Lawrence Erlbaum Associates.

Bompa, T., & Buzzichelli, C. (2019). Periodization training for sports (3rd ed.). Human Kinetics.

Capulis, S., Dombrovskis, V., & Guseva, S. (2014). Karate-Do as a means to implement humanistic approach in sports education. Procedia-Social and Behavioral Sciences, 112, 141-146. https://doi.org/10.1016/j.sbspro.2014.01.1148

Danardono. (2006). Sejarah, etika dan filosofi seni beladiri karate. Universitas Negeri Yogyakarta Press.

Dwojaczny, B., Bejtka, M., Iermakov, S., Potop, V., Yermakova, T., & Cieślicka, M. (2021). Effects of karate training on cognitive functions in young athletes. Journal of Physical Education and Sport, 21(5), 2473-2479. https://doi.org/10.7752/jpes.2021.05333

Ericsson, K. A., Krampe, R. T., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. Psychological Review, 100(3), 363-406. https://doi.org/10.1037/0033-295X.100.3.363

Fandayani, W. (2019). Analisis teknik tendangan dominan terhadap perolehan poin pada pertandingan kumite cabang olahraga karate. Jurnal Kepelatihan Olahraga, 11(1), 21-29. http://ejournal.upi.edu/index.php/JKO

Hariri, S., & Sadeghi, H. (2018). Biomechanical analysis of Mawashi-Geri technique in karate: Review article. International Journal of Sport Studies for Health, 1(4), 1-8. https://doi.org/10.5812/intjssh.84349

Kautzner, N., & Junior, M. (2022). Punch and kick impact of the karate: A review. Marathon, 14(2), 66-76. https://doi.org/10.24818/mrt

Kellmann, M., & Beckmann, J. (Eds.). (2018). Sport, recovery, and performance: Interdisciplinary insights. Routledge.

Magill, R. A., & Anderson, D. I. (2017). Motor learning and control: Concepts and applications (11th ed.). McGraw-Hill Education.

Oktavian, I. D., Sugiyanto, & Syaifullah, S. M. (2022). Relationship between agility, speed, leg muscle strength, dynamic balance with Mawashi Geri kick accuracy in karate. International Journal of Multidisciplinary Research and Analysis, 5(9), 2461-2467. https://doi.org/10.47191/ijmra/v5-i9-17

Quinzi, F., Camomilla, V., Di Mario, A., Felici, F., & Sbriccoli, P. (2016). Repeated kicking actions in karate: Effect on technical execution in elite practitioners. International Journal of Sports Physiology and Performance, 11(3), 363-369. https://doi.org/10.1123/ijspp.2015-0162

Rangkuti, Y. A., Novita, N., Purnomo, E., & Kurniawan, R. (2020). Pengembangan variasi latihan tendangan Mawashi Geri Jodan pada atlet karate kategori kumite. Jurnal Kepelatihan Olahraga, 5(2), 81-89. https://performa.ppj.unp.ac.id/index.php/kepel

Roediger, H. L., Weldon, M. S., & Challis, B. H. (1989). Explaining dissociations between implicit and explicit measures of retention: A processing account. In H. L. Roediger & F. I. M. Craik (Eds.), Varieties of memory and consciousness: Essays in honour of Endel Tulving (pp. 3-41). Lawrence Erlbaum Associates.

Sasmita, N., Januarto, O. B., & Kurniawan, A. (2022). Upaya meningkatkan keterampilan teknik dasar tendangan Mawashi-Geri beladiri karate menggunakan metode drill bagi karate Inkado. Sport Science and Health, 4(1), 83-93. https://doi.org/10.17977/um062v4i12022p83-93

Schmidt, R. A., & Lee, T. D. (2019). Motor learning and performance: From principles to application (6th ed.). Human Kinetics.

Setiawaty, I. (2020). Fanatisme pada perguruan cabang olahraga karate ditinjau dari budaya dan olahraga (Studi kasus pada dojo di Kabupaten Jepara). [Master's thesis, Universitas Negeri Semarang]. UNNES Repository.

Sugiyono. (2018). Metode penelitian kuantitatif, kualitatif, dan R&D (28th ed.). Alfabeta.

Togatorop, R. R., & Endriani, D. (2022). Pengembangan variasi latihan tendangan Ushiro Mawashi Geri pada atlet kumite karate. Journal Physical Health Recreation, 2(2), 172-178.

World Karate Federation. (2024). Kumite competition rules: Version 13.0. World Karate Federation.

Wulf, G., & Shea, C. H. (2002). Principles derived from the study of simple skills do not generalize to complex skill learning. Psychonomic Bulletin & Review, 9(2), 185-211. https://doi.org/10.3758/BF03196276

Yudhistira, D., Suherman, W. S., Wiratama, A., Wijaya, U. K., Paryadi, Faruk, M., Hadi, H., Siregar, S., Jufrianis, & Pratama, K. W. (2021). Content validity of the HIIT training program in special preparations to improve the dominant biomotor components of kumite athletes. International Journal of Human Movement and Sports Sciences, 9(5), 1051-1057. https://doi.org/10.13189/SAJ.2021.090527

Yudhistira, D., & Tomoliyus. (2020). Content validity of agility test in karate kumite category. International Journal of Human Movement and Sports Sciences, 8(5), 211-216. https://doi.org/10.13189/saj.2020.080508