EFFECTS OF TEAM-BASED LEARNING (TBL) INSTRUCTION ON THE CONTINUOUS STRIKE ABILITY OF BACK WAIST WHIP LEG IN UNIVERSITY WUSHU SANDA COURSES*

Fan Yachen[1] and Phanu Kusolwong[2]

[1-2]Faculty of Physical Education, Srinakharinwirot University, Thailand

Corresponding author E-mail: phanu@g.swu.ac.th

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Abstract

This research aimed to investigate the effects of team-based learning (TBL) instruction on students' technical standardization and continuous strike stability of the back waist whip leg, to compare the effects of TBL and traditional instruction on students' tactical awareness and theoretical knowledge in Wushu Sanda, and to evaluate the influence of TBL instruction on students' teamwork ability and learning attitude. A randomized controlled teaching experiment was conducted with 60 male freshmen from Henan Agricultural University, who were randomly assigned to a TBL group and a traditional instruction group, with 30 students in each group. The intervention lasted for 8 weeks. The research instruments included technical performance evaluation, continuous strike stability indicators, a theoretical knowledge test, and questionnaires on teamwork ability and learning attitude. Data were analyzed using mean, standard deviation, paired-sample t-test, and independent-sample t-test.

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The results showed that: 1) the TBL group achieved significantly higher technical standardization and better continuous strike stability than the traditional group after the intervention; 2) the TBL group showed significantly better tactical decision-making accuracy and theoretical knowledge scores than the traditional group; and 3) the TBL group obtained higher scores in communication and collaboration, responsibility sharing, conflict resolution, and learning attitude. These findings indicate that TBL instruction can effectively improve technical, cognitive, social, and affective learning outcomes in university Wushu Sanda courses, and it provides a practical teaching approach for enhancing the learning of complex martial arts skills.

Keywords: Team-Based Learning, Wushu Sanda, Back Waist Whip Leg, Continuous Strike Ability. Physical Education

Introduction

The Wushu Sanda is a Chinese fighting sport which is based on the kicking, punching, throwing, controlling of distance and reacting to the situation. The competition rules and judging system in the Sanda Competition are built with regard to practical combat activities, the score criteria, round time frame, weight classes, and safety measures (International Wushu Federation, 2017). The physical education at the universities includes the Sanda courses where the students learn how to develop their body fitness, technique, knowledge, and respect towards the martial arts culture. One of the examples of the kicking techniques used in the Sanda is the back waist whip leg, as it involves turning the trunk, hip movement, lower limb acceleration, balance, and recovery after the impact. The biomechanics of the roundhouse kick has been studied in order to understand the factors that contribute to successful kicking: speed of rotation of the pelvis, movement of the hips, extension of the knees, and center of mass

control can be used to explain why it is not easy to perform the whip kicking movements by demonstration and imitation (Gavagan & Sayers, 2017).

The conventional method of teaching Sanda is a teacher-based approach that involves explanation, demonstration and the subsequent imitation and correction by individual students. It is also possible to teach the form of movement in its most basic form but this can only be done with the help of limited peer observation and tactical talk as well as group problem solving. In the complicated kicking process, the learner should learn to correlate technical style and time, rhythm, selection of target and constant control of strike. Hence, it is more likely to achieve the desired effect on skill acquisition among students when the model of instruction includes personal responsibility, team discussion, practical application, and real-time feedback.

Team-Based Learning (TBL) is a small group learning. TBL was described as a method of teaching that involves the use of groups to teach students, but not in the usual way. The authors stated that it is a form of team-based learning and not an activity of normal teams. It was mentioned by them that good TBL should be done with well-organized groups, where the students are held responsible, there is a constant review of the activities of the group members, and they have to take decisions on the basis of the given situations. Parmelee et al. (2012) also explained the working procedure of TBL by means of preparation, readiness assurance, application practice, and peer feedback. Team Based Learning was initially designed to be applied to higher education environment and has been extensively used in medical and health professional education (Parmelee et al., 2012; Hrynchak and Batty, 2012). The fact that it focuses on the preparation and responsibility, decision making by the team and the tasks to apply will give a good ground to adapt the model to the physical education in the university. In Sanda teaching, the TBL approach can be employed in the grouping of students into stable groups, technical observation, creation of

scenarios of tactics and encouraging the students to interact with one another in the repeated process.

This paper is a theoretical extension of the TBL studies that have been conducted in the context of knowledge-based higher education institutions to the area of motor skill learning, which takes place at universities as part of physical education. It also connects the Wushu Sanda teaching process with the technical, cognitive and affective results of cooperation between people. The study itself is a practical approach to the design of a simplified instruction on the back waist whip leg using team activities, peer correction, and practice application. The result can assist the university PE teachers to shift towards the demonstration of single action towards the ability oriented sanda teaching by incorporating technical form, repeated strike control, tactical awareness and group learning.

Objectives

1. To investigate the effects of TBL instruction on students' technical standardization and sustained strike consistency of the back waist whip leg.

2. To compare the effect of TBL and traditional instruction on students' tactical awareness and theoretical knowledge in Wushu Sanda.

3. To evaluate the influence of TBL instruction on students' teamwork ability and learning attitude.

Literature Review

1. Team-Based Learning: Definition and Core Process

Michaelsen and Sweet (2008) described TBL as a consistent cluster of instructional practices, not the normal group work. They stressed that good TBL relies on well-established teams, student responsibility, regular feedback, and tasks which demand teams to make certain decisions. This definition is relevant

to the current research since Sanda practice demands students to go beyond passive imitation and be able to judge movement errors, rhythm control and tactical application.

Parmelee et al. (2012) have given a practical guide to TBL and described the process of its operation in terms of preparation, readiness assurance, application exercises, and peer evaluation. According to their guide, TBL is student-centered but instructor-led. This characteristic can be applied to university Wushu Sanda instruction since the teacher will be able to regulate safety and technical requirements as well as students will be able to discuss and solve practice problems in groups.

The educational theory of TBL was described by Hrynchak and Batty (2012). They claimed that TBL is based on the principles of constructivist learning and social learning as students create knowledge by preparing, interacting, and applying. This rationale justifies the use of group discussion and peer feedback in the current study to enable students realize why the back waist whip leg needs coordinated trunk rotation, hip movement, rhythm control and stable recovery.

Fatmi et al. (2013) have conducted a literature review of TBL in the field of health professions education and it has been revealed that most studies have shown an increase in knowledge outcomes, which were not positive towards learners. The above result indicates that TBL is to be measured on the basis of various results instead of one score of the test. Thus, the technical performance, constant strike stability, tactical awareness, theoretical understanding, ability to work with others, and attitude to learn are estimated by this study.

2. TBL and Cooperative Learning in Physical Education

Casey and Goodyear (2015) examined the cooperative learning in physical education and claimed that it can lead to physical, cognitive, social, and affective learning results when applied with enough structure and fidelity. Their review is applicable as TBL also demands students to learn by means of organized team tasks instead of informal group activities. This helps to support the current study

application of team-based practice to enhance technical and non-technical outcomes.

Bores-Garcia et al. (2021) have also done a systematic review of the most recent studies on cooperative learning in physical education and it was found that the cooperative learning is used in various PE environments. They have proved that group teaching, which is well-organized, can be used to meet the needs of both teachers in terms of skills as well as social development. It is also in line with the current research that has considered teamwork ability and attitude towards learning and technical performance.

Fernandez-Espinola et al. (2020) performed a systematic review and meta-analysis of cooperative learning interventions and intrinsic motivation in physical education. Their research implies that the cooperative learning can enhance the motivation of students, however, the quality and heterogeneity of evidence must be taken into account. This argument favors the incorporation of learning attitude as an outcome of the current study.

Yang et al. (2021) have studied the cooperative learning in physical education and discovered that it improved basketball action skills and motivation to learn. Despite the differences between basketball and Sanda in technical content and safety, both involve movement repetition, decision making and peer interaction. This is an indication that a structured team-based model can be tested in martial arts skill instruction.

3. Back Waist Whip Leg Technique and Continuous Strike Ability

The Sanda competition is based on the principles of the International Wushu Federation (2017) that is, it is organized to perform practical combat activities and scoring rules, weight classes, as well as safety. The nature of this rule is such that a Sanda lesson in the university should be taught with technical actions rather than individual fitness exercises. It has to be precise, precise, and applicable in tactical conditions of kicking techniques.

Gavagan and Sayers (2017) studied expert roundhouse kicking in various martial arts, and concluded that good kicking performance requires fast pelvis rotation, hip action, knee extension and centre of mass control. While this research was not specific to the Sanda back waist whip leg, the biomechanics reasoning applies since whip-like kicks rely on coordinated proximal-to-distal motion and stable body control.

Recent biomechanical analysis of Sanda kicks has also demonstrated that kicking performance is associated with coordinated kinetic and kinematic attributes, which adds further support for the assessment of technical stability and force control (Eltifi-Ghanmi et al., 2025).

Methodology

1. Research Design and Participants

A randomized controlled teaching experiment was conducted. Sixty male freshmen taking university physical education courses at Henan Agricultural University participated in the study. All students were aged 18-22 and had no systematic combat sports training experience. They were randomly assigned to an experimental group (TBL instruction, n = 30) and a control group (traditional instruction, n = 30). The intervention lasted 8 weeks, with one 90-minute session each week. Both groups learned the same back waist whip leg content and were taught by the same teaching team. The only difference was the instructional mode.

Table 1 Participant information.

Group	n	Gender	Age range	Height (cm)	Weight (kg)
TBL group	30	Male	18-22	175.3 ± 5.2	68.5 ± 7.1
Traditional group	30	Male	18-22	174.8 ± 5.5	67.9 ± 6.8

2. Instructional Intervention

The TBL group followed four procedures: pre-class preparation, readiness assurance, team application tasks, and peer feedback. Students were organized into stable teams. Before class, they reviewed short materials on action essentials and Sanda rules. In class, they completed individual and team readiness checks, practiced technical tasks, corrected movement errors within teams, and reported team solutions. The control group followed traditional teacher demonstration, individual imitation, repeated practice, and teacher correction. Both groups used the same teaching content and assessment standards.

Table 2 Compact eight-week teaching plan.

Weeks	Main content	TBL group focus	Assessment focus
1-2	Basic form, hip rotation, supporting-leg control, footwork connection	Team task cards, peer observation, readiness check	Action standardization and rhythm
3-4	Continuous strike endurance, moving target practice, rule understanding	Group challenge, error correction, route design	Completion quality, hit accuracy, stability
5-6	Speed, force control, distance control, simulated attack-defense practice	Team comparison, tactical scenario design	Force attenuation, tactical completion
7-8	Integrated combination practice and final assessment	Team presentation, peer feedback, comprehensive review	Technical score, stability indicators, knowledge test, questionnaires

3. Research Instruments

Four tools were maintained in order to ensure that the approach remained on course with the updated goals. To begin with, technical

performance evaluation was done by three competent Sanda evaluators who scored blindly. The overall technical score included standardization of movement, continuous quality of strike and practicality. Second, stability indicators of continuous strikes were the standard deviation of time interval of strikes, the standard deviation of shift of center of gravity, and rate of attenuation of force during repeated back waist whip leg movements. Third, a theoretical knowledge test tested students on their knowledge of principles of movement, rules, safety and tactical application. Fourth, teamwork ability and learning attitude were measured through questionnaires which used 5-point Likert items. Communication and collaboration, responsibility sharing, and conflict resolution were addressed in the teamwork questionnaire. Learning interest, participation, confidence, and perceived usefulness of the teaching mode were evaluated using the learning attitude questionnaire.

Three experts in teaching the Sanda were consulted to examine the technical rating rubric that was used before the experiment. The overall performance of the technical aspect was measured by the average score of three raters. The consistency of inter-raters had been assessed prior to the official analysis and the reliability of the technical assessment. The items of the questionnaire of teamwork ability and learning attitude were borrowed on the basis of some relevant indicators of educational measurements and were examined by the physical education teaching professionals on content validity.

4. Data Collection and Analysis

The data were pre-test and collected before the 8-week intervention. The post-test data was gathered in the last week. Statistical analysis was conducted using SPSS 26.0. The descriptive statistics were presented as mean and standard deviation. To compare within-group differences between pre-test and post-test, paired-sample t-tests were employed. To compare the difference between the TBL group and the traditional group at post-test, independent-sample t-tests were used. The level of significance was $p < .05$ and $p < .01$ was highly significant.

5. Ethical Considerations

The students were volunteers and they consented to participate in the study. The teaching activities were organized based on university PE safety standards. The personal information was anonymized prior to analysis. There was no academic punishment on the part of the students who could leave the study.

Results

1. Effects on Technical Standardization and Continuous Strike Stability

The first objective was to examine whether TBL instruction improved students' technical standardization and continuous strike stability. Table 3 shows that both groups improved after 8 weeks, but the TBL group achieved a higher post-test technical standardization score than the traditional group. The TBL group also showed smaller strike interval variation, smaller center-of-gravity shift, and lower force attenuation rate. These results indicate that TBL instruction was more effective in helping students maintain standardized and stable repeated execution of the back waist whip leg.

Table 3 Technical standardization and continuous strike stability results.

Indicator	TBL group	Traditional group	Comparison	t-value	p-value
Technical standardization pre-test	14.2 ± 2.8	13.8 ± 3.1	Baseline	-	$p > .05$
Technical standardization post-test	25.3 ± 3.2	20.1 ± 3.8	Inter-group post-test	6.28	$p < .01$
Strike interval SD (s)	0.12 ± 0.03	0.21 ± 0.05	Post-test	9.36	$p < .01$
Center of gravity shift SD (cm)	2.3 ± 0.8	4.5 ± 1.2	Post-test	8.74	$p < .01$

Force attenuation rate (%)	8.5 ± 2.1	15.3 ± 3.2	Post-test	10.18	p < .01

2. Effects on Tactical Awareness and Theoretical Knowledge

The second objective was to measure the impact of TBL on the tactical and theoretical knowledge. As Table 4 reveals, the accuracy in making tactical decisions by the group that used the TBL was much higher than that of the other group in the test. The intervention also had a greater score of theoretical knowledge in the TBL group. The results of the study indicate that it was not only the practice of movement but also the process of learning the concept of how to use tactics, rules and technical concepts that were supported by the process of the TBL.

Table 4 Tactical awareness and theoretical knowledge results.

Indicator	TBL group	Traditional group	Comparison	t-value	p-value
Tactical decision-making accuracy	82.3 ± 7.5%	65.7 ± 8.2%	Post-test	8.62	p < .01
Theoretical knowledge pre-test	58.2 ± 7.3	57.5 ± 7.8	Baseline	-	p > .05
Theoretical knowledge post-test	85.6 ± 6.8	72.3 ± 7.5	Inter-group post-test	7.41	p < .01

3. Effects on Teamwork Ability and Learning Attitude

The third objective was to evaluate the influence of TBL instruction on teamwork ability and learning attitude. Table 5 shows that the TBL group achieved higher post-test scores than the traditional group in communication and collaboration, responsibility sharing, conflict resolution, and learning attitude. Traditional-group pre-test scores were 3.1 ± 0.6, 3.2 ± 0.6, 3.0 ± 0.7, and 3.3 ± 0.6 respectively. The results indicate that stable team organization, shared practice

tasks, peer correction, and group reflection contributed to students' social and affective learning outcomes.

Table 5 Teamwork ability and learning attitude results.

Indicator	TBL pre	TBL post	Traditional post	Inter-group t	p-value
Communication and collaboration	3.2 ± 0.5	4.3 ± 0.4	3.3 ± 0.5	10.25	p < .01
Responsibility sharing	3.3 ± 0.5	4.4 ± 0.4	3.4 ± 0.5	11.36	p < .01
Conflict resolution	3.1 ± 0.6	4.2 ± 0.4	3.2 ± 0.6	9.78	p < .01
Learning attitude	3.4 ± 0.5	4.5 ± 0.3	3.5 ± 0.5	12.87	p < .01

Discussion

1. Effects on Skill Performance and Tactical Awareness

It was found that the TBL instruction helped to enhance the technical standardization of the students and their stability of strike on a continuous basis than in the traditional teaching. This is because of the TBL structure. The movement knowledge was also prepared by the students prior to the class, they were given readiness tests, trained in groups, and the teachers gave them feedbacks. These procedures offered greater chances to witness mistakes, verbalize the principles of movements, and correct the technical aspects. In order to make back waist whip leg work, one should have a trunk rotation, hip drive, control over the supporting legs, rhythm of the striking, and recovery. Team observation enabled the students to see the links between the unstable movements and to keep them more stable in the following strikes.

The TBL was also beneficial in terms of tactical knowledge as the students had to learn to apply technical movement and warfare. Students were not only taught to perform the back waist whip leg as a single action but they also talked

about when it is appropriate to use this technique, how far to reach the target, etc. This design was task based and enhanced decision making on tactics. It can be concluded that the findings are an evidence of the applicability of TBL to complicated sports skills where there is a need to combine the practicality of a particular skill with the scenario-based approach.

2. Effects on Knowledge and Learning Experience

The TBL group was more successful in the theoretical knowledge because of the fact that students had to learn and discuss, as well as use the conceptual knowledge during the process. Team tasks were based on rules, safety, force generation principles, and tactical ideas. It has been made easier to study theory and make it practical. The students also had to justify their decision-making with the teammates which could have helped them to remember and comprehend.

The ability to work in a team and the learning attitude is also an aspect of the design of TBL. There were repeated opportunities of communication, sharing of responsibility, and conflict resolution by stable teams. The peer correction and group tasks made the students feel that they are involved and have accomplished something. TBL provided a more active participation of students in the organization of practice and the feedback as compared with the traditional teaching methods. This could be attributed to the fact that the TBL group was able to give better attitudes towards learning after the intervention.

3. Pedagogical Implications for Wushu Sanda

The results are of practical use in the context of the teaching of Wushu Sanda at universities. To begin with, TBL can be employed to integrate technical and tactical knowledge in Sanda classes. The teacher will have a chance to form teams that remain constant, he or she may assign the observation of movement to the students, and also make them take decisions on some technical issues. Second, it is necessary to measure the performance of the both non-technical and technical aspects. A more comprehensive understanding of the effectiveness of courses may be achieved through the presence of continuous strike stability,

the level of awareness of tactics, the ability to work in a team, and the attitude towards learning. Third, there should be modification of TBL to suit the safety standards of combat sports. Training intensity, protective gear, degree of contact, and the transition of training to real-life application are still the things which teachers need to manage. This will enable TBL to assist the reforming of the Sanda course as well as the quality of the course itself.

4. Conclusion

The present study concluded that 8 weeks of TBL led to significant improvements in back waist whip leg learning for university students in Wushu Sanda courses. Compared with traditional instruction, TBL resulted in superior performance in terms of technical standardization, continuous strike stability, tactical awareness, theoretical knowledge, teamwork ability and learning attitude. The results suggest that complex motor skills learning can be facilitated by TBL when the team preparation, readiness assurance, application activities and peer feedback are embedded in PE teaching. The findings also revealed that university Sanda instruction should not only focus on technical performance but also include a wider range of learning outcomes such as tactical understanding, cooperation and attitude.

Recommendations

1. Theoretical Recommendations

The TBL can be introduced in the University Wushu Sanda courses gradually. Educators can start with stable teams, short readiness tasks, peer observation forms and structured technical challenges. Movement form should be linked to continuous strike control and tactical situations when it comes to teaching tasks. Technical standardization, stability indicators, knowledge testing, teamwork ability, and learning attitude are to be assessed.

2. Future Research Recommendations

Future studies should increase the sample size, involve female students and students from other universities, and prolong the intervention period. Future research could also compare the effects of TBL on different Sanda techniques, and utilize objective motion analysis tools to validate changes in strike rhythm, force, and movement stability.

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