



The Effect of Special Exercises Using a Mirror on Learning the Back Roundhouse Kick (Hajw - Jaki) among Taekwondo Learners Aged 12–14 Years

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DOI:

[https://doi.org/10.37359/JOPE.V38\(3\)2026.2630](https://doi.org/10.37359/JOPE.V38(3)2026.2630)

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Article history: Received 16/ September/2026; Accepted 23/September /2026; Available online 28/ September/2026

Abstract

This research objectives to determine the impact of utilizing a mirror as a teaching tool on learning the back roundhouse kick (Hajw - Jaki) in Taekwondo among learners aged 12-14. The researcher used an experimental design with two equivalent groups. The research sample consisted of 20 learners randomly separated into two same groups: an experimental group of 10 learners who learned using a mirror and a control group of 10 learners who learned using the traditional method without a mirror. The experiment lasted for six weeks with three training sessions per week, totaling 18 training sessions .The researcher used a form to evaluate the skill performance of the back roundhouse kick and employed pre- and post-tests to measure learning levels. The learning conditions for both groups were standardized in terms of coach, time, content, location and number of repetitions with the only difference being the use of a mirror. The data were statistically analyzed using the mean, standard deviation and t-tests for paired and independent samples. The results present a statistically significant development in the performance of both groups between the pre- and post-tests with the improvement being greater in the experimental group. The findings also indicated no significant differences between the two groups in the pre-test while significant differences emerged in the post-test in favor of the experimental group demonstrating the effectiveness of using a mirror in improving skill learning. The research concluded that the mirror is an effective teaching tool for learning complex motor skills in Taekwondo as it provides immediate visual feedback that contributes to correcting errors and improving balance, accuracy and motor coordination. The research recommended its adoption in teaching Taekwondo learners aged 12-14 and conducting similar studies on other skills and age groups.

Keywords: Taekwondo, Teaching Mirror, Visual Feedback, Motor Balance.

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Introduction

Taekwondo is a martial art that has witnessed significant development in both training and competition, due to its complex motor skills that rely on speed, neuromuscular coordination and precision. Kicking is a fundamental aspect of this sport, serving as the primary means of scoring points and achieving dominance during competitions.

Scientific literature supports this view; performance analyses in high-level taekwondo competitions indicate that the technical and tactical actions leading to scoring are strongly connected to the strategic use of kicks in accordance with the demands of the competitive situation. Furthermore biomechanical studies demonstrate that kick effectiveness relies on the terminal velocity of the foot, the contribution of the torso and rotation and the coordinated movement sequence between body parts. This reinforces the view of kicking skills as a fundamental factor of technical and competitive superiority in taekwondo (Menescardi et al., 2019; Jung & Park, 2022).

Among these skills, the backhand roundhouse kick to the head (Hajju-Jaki) stands out. It is performed with a full body rotation raising the leg straight and then bending it. The kick is delivered with the sole of the foot while bent and with the heel when the leg is straight. The execution is performed from the same movement as in a sparring match and a successful kick to the head by the player in a sparring match can earn six points. This skill is considered one of the advanced skills that demands a high degree of balance, motor coordination and precision in directing the movement. It also comprises a backward rotation of the body while directing the strike towards the target, which demands high kinesthetic awareness and the capacities to control the body parts during execution. Teaching and developing this skill requires following scientific methods that enhance traditional scientific processes given the precise coordination and synergy required by all parts of the body particularly since this skill demands the transfer of movement through the body's joints and the synergistic action of the working muscles.

Biomechanical studies of taekwondo kicks support this description; they have shown that back kicks and rotational kicks require precise coordination between the hip, knee and torso joints, and that the speed and effectiveness of the kick are linked to the synergistic pattern between the joints and the phases of rotation and attack, as well as the role of the pivot leg in maintaining balance and control during execution. Moreover this skill is considered a complex skill that demands a high level of motor control and mechanical precision (Kim et al., 2011; Cheng et al., 2015).

The 12-14 age group is important stage in learning motor skills characterized by a high capacity for learning due to continuous development in the nervous system and enhanced coordination. This stage represents a significant foundation for building correct movement patterns upon which advanced skill performance in later stages depends. However the complex nature of



the backhand roundhouse kick can pose a challenge for learners due to limited visual perception during the execution of the movement, potentially leading to errors in balance or direction.

Recent reviews demonstrate that learning motor skills in late childhood and early adolescence is associated with significant cognitive-motor advantages and that developing coordination, agility, and motor experience during this period contributes to constructing a better foundation for subsequent skill learning. Studies of taekwondo players aged 11–14 years have also shown that practice is related to with faster development of postural control and sensory functions connected to balance as well as better adaptations in responding to specific visual stimuli related to the sport—all of which are crucial elements in learning compound kicks that require rotation and precise direction of movement (Shi & Feng, 2022; Fong et al., 2012; Chung & Ng, 2012). In light of the development in sports training methods the importance of using assistive educational tools that contribute to improving the motor learning process has emerged. Among these tools is the mirror, which provides immediate visual feedback, enabling the learner to see his performance during execution and compare it to the correct model of the movement. This idea connect with the findings of systematic reviews in motor learning. Evidence suggests that feedback is a important factor in improving skill acquisition during motor lessons and educational programs. Visual feedback, consist of visual modeling and performance review may be more effective than verbal instruction alone in some educational contexts because it helps learners identify errors and connect actual performance to the desired model. Therefore a mirror can be considered a simple tool for providing immediate visual feedback during learning (Zhou et al., 2021; Mödinger et al., 2022).

This helps promote self-correction of errors and the development of a clear kinesthetic perception of movement. Furthermore using a mirror strengthens the connection between kinesthetic sensation and visual perception which helps learners better understand body positions and angles of rotation, thereby developing performance accuracy and speed and decreasing motor errors. The significance of this research lies in highlighting the use of mirrors as a teaching tool in learning one of the fundamental skills in Taekwondo the back roundhouse kick to the head (haju-jeki), among Taekwondo learners aged 12–14 years. This may contribute to the development of teaching and training methods in this sport.

Regarding mirrors specifically available evidence suggests that mirror visual feedback may contribute to supporting motor representation and sensory-motor perception in several contexts. However, systematic reviews also indicate that direct evidence for improved motor performance in healthy individuals remains limited and inconsistent. Therefore the most scientifically accurate formulation of this study is that mirror use may aid in self-correction and improve coordination and visual-motor perception during the learning of the back roundhouse kick to the head. This gives the research practical and experimental value within the context of teaching Taekwondo to young people (Chen et al., 2019; Deconinck et al., 2015).



Method and Tools

The researcher used the experimental method with two equivalent groups (experimental and control) as it was appropriate for the nature of the research problem. The research population included of 72 Taekwondo learners of meltable ages at the (Olympic Champion School) club in Baghdad Governorate. The research sample was chosen purposively and the sample consisted of (20) learners aged (12-14) years and they were randomly divided into two groups: an experimental group that learned using its exercises with a mirror and a control group that learned using the traditional method used in teaching. Equivalence was achieved between the members of the two groups in the level of skill performance before the start of the experiment.

The researcher used a range of tools and methods including skill performance evaluation forms, two large mirrors, taekwondo training equipment, a mobile phone camera and a skill test for performing the back roundhouse kick to the head. The technical performance evaluation test for the back roundhouse kick to the head based on the " Hajw - Jaki " movement, was adopted as described below (Al-Farijawi, 2023).

Test name: The roundhouse kick to the head from the movement (Hajw - Jaki).

The aim of the test: To measure the skill performance of the back roundhouse kick to the head from the (Hajju-Jaki) movement.

Tools used:

- Taekwondo electronic scoring device (electronic head guard).
- A gelatinous marker onto which the electronic head guard is attached.
- Sensitive sole of the foot.
- Points recording form.
- Whistle.

Test instructions:

- Each player is given three attempts.
- The score is out of 10 for each attempt.
- The player chooses his favorite man when performing.
- If the attempt is inaccurate (the main part of the kick), it is considered a failure and no marks are given.
- A registration form is distributed to the experts (arbitrators) that includes dividing the skill into three parts: the preparatory part (3 marks) the main part (4 marks) and the concluding part (3 marks).



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- The electronic scoring device specific to Taekwondo (head guard) was used to determine whether the attempt was correct (accurate) or not.

Method of performance

- The player stands in the taekwondo ready stance after choosing his preferred leg for the performance.
- In front of the testing device, make sure that the distance between the player and the testing device is appropriate (taking into account the height difference between the players) and upon hearing the starting signal (whistle) the player begins to perform the back important kick to the head from the movement on the testing device and then returns to the ready position after performing.

Registration

- Calculate the best score from the three attempts of the back roundhouse kick to the head from the (Hajw - Jaki) movement.

In order to ensure the success of the research experiment the researcher conducted a pilot experiment on (5) learners outside the research sample in order to establish the suitability of the exercises using the mirror and to ensure the validity of the tests and tools used. This was followed by the implementation of the educational program for (6) weeks with (3) educational units per week, i.e., 18 units. The experimental group implemented the exercises using the mirror while learning the back roundhouse kick to the head while the control group received the education according to the traditional method followed. The researcher ensured that the content was the same for both groups in terms of skill order, progression from easy to difficult, number of repetitions, rest periods, unit time, and trainer explanation; so that the only difference (independent variable) would be the use of the mirror for the experimental group.

The proposed learning unit was divided into

- Introductory section (10 minutes): General and specific warm-up, flexibility exercises and activation of the working joints.
- Main section (45 minutes): Skill explanation, performance demonstration, partial and then full exercises, repeated applications, feedback and error correction.
- Concluding section (5 minutes): Cool-down and brief review of technical points.

The teaching mechanism in the experimental group for this skill involved using a mirror as a means of immediate visual feedback. During the performance the learner was needed to

observe the position of the supporting foot, the direction of rotation, the height of the knee, the trajectory of the kick, the balance of the torso and the return to the starting position. The coach also used the mirror to direct the learner's attention to areas of error and to compare it with the correct model. This approach is based on literature indicating that feedback is beneficial in learning motor skills, and that visual feedback may be particularly useful for skills requiring form control, precision and coordination of body positions. Furthermore some evidence suggests that learners with lower skill levels benefit from simultaneous visual feedback.

In contrast, the teaching mechanism in the control group was the traditional method, relying on verbal explanations from the instructor, demonstrations of the practical model, and verbal and repetitive error correction, without the use of a mirror. Both groups received the same time, content, number of attempts, and error correction in terms of frequency, but without the direct visual feedback provided by a mirror.

The organization of the training program over the six weeks was as follows:

- Week 1: Introduction to the skill and its importance, teaching the correct ready position, training on balance, direction of gaze, initial rotation of the trunk and pelvis and simple balance exercises.
- Week 2: Teaching the preparatory part of the kick, the transition from the ready position to the rotation, raising the kicking leg, and stabilizing the pivot leg with slow and segmented execution.
- Week 3: Moving on to linking rotation and kicking in a near-complete manner using a fixed and low-intensity target and focusing on the correct path of movement.
- Week 4: Perform the entire skill more smoothly with an increased number of repetitions, focusing on balance after the strike and returning to the ready position.
- Week 5: Improving accuracy and fluidity, addressing individual errors and practicing at fixed heights and distances while emphasizing control of direction and balance.
- Week 6: Consolidating skill performance, implementing the skill in a form closer to a test, gradually decreasing aids then preparing learners for the post-test.

In order to obtain the research results the data were statistically processed using the SPSS V26 program and using the laws of the arithmetic mean and standard deviation and the (t) test for related and independent samples.



Results

Table 1. shows the means and standard deviations in the technical performance evaluation test for the back roundhouse kick to the head from the (Hajju-Jaki) movement in the pre- and post-tests for the control and experimental groups.

Group	Unit	Pre-Test		Post-Test	
		M	Sd	M	Sd
control	Score	2.750	0.857	4.150	0.973
experimental	Score	2.700	0.888	5.000	1.291

Table 2. shows the difference in means, standard deviation, calculated t-value, significance of differences, and percentage change between the results of the pre- and post-tests in the technical performance evaluation test for the back roundhouse kick to the head from the (Hajju-Jaki) movement for the control and experimental groups.

Group	Unit	D	SE Diff.	Calculated t-value	Level Error	Significance of Differences	Percentage of Change %
control	Score	1.400	0.994	4.452	0.002	Significant	50.910
experimental	Score	2.800	0.587	15.087	0.000	Significant	103.704

*Below the significance level (0.05) and degrees of freedom (9).

Table 3. shows the arithmetic means, standard deviations, calculated t-value, error level, and significance of the differences between the two research groups in the technical performance evaluation test for the back roundhouse head kick from the (Hajju-Jaki) movement in the pre- and post-tests.

Tests	Unit	Control Group		Experimental Group		calculated t-value	error level	significance
		Sd	D	Sd	D			
Pre	Score	2.750	0.857	2.700	0.888	0.128	0.900	Random
Post	Score	4.150	0.973	5.000	1.291	2.641	0.017	Significant

Below the significance level of (0.05) and degrees of freedom (18).

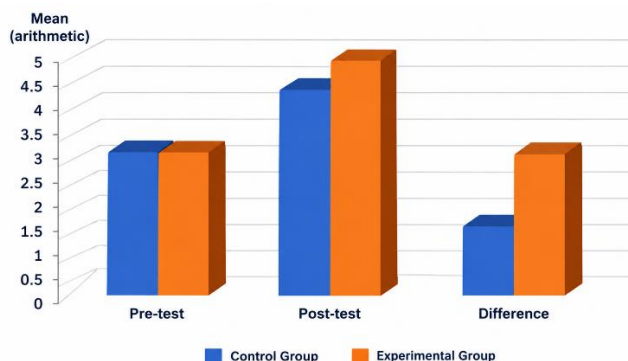


Figure 1. shows the arithmetic means and the difference in arithmetic means between the pre- and post-test results for the experimental and control groups in the technical performance evaluation test for the back roundhouse kick to the head from the (Hajju Jaki) movement.

Discussion

Table (2) shows an improvement in the technical performance level of the back circular kick to the head from the movement (Hajju Jaki) among the individuals of both the experimental and control groups between the results of the pre-test and post-test, in favor of the post-test, as the arithmetic means for both groups increased. This indicates that mastery occurred in learning the skill under investigation in both groups. However the development of the experimental group that used the mirror was greater than that of its control counterpart that used traditional learning.

What confirms the superiority of the experimental group over the control group can be observed through the significant differences between the two groups in the post-test results, as the differences appeared significant in favor of the experimental group at the significance level of (0.05), knowing the randomness of the differences between the two groups in the heart test, which indicates the equivalence of the two groups and that the greatest improvement of the experimental group was due to the interference of the independent variable represented by the use of the mirror in learning the back circular kick to the head from the movement (Hajju Jaki) compared to the traditional learning used by the control group.

When learning a specific motor skill it is beneficial to receive corrective feedback on performance from the coach (Diller et al., 2022). This feedback can be about the performance itself or the outcome supporting the learner correct mistakes. While this is an important and effective method the player has no prior knowledge of the movement they performed and correcting their performance depends on the coach's advice and their own experience with the movement. Consequently learning to reach advanced levels may take a long time.



The function of the mirror in learning motor skills is to provide immediate visual feedback, which helps the learner correct their movement. The improvement observed in the experimental group can be explained by the learner's capacities to instantly improve their body positioning while performing the movement. This improvement is achieved by comparing the actual position of their body parts with the desired model which they observe from the instructor. This is particularly relevant to the trajectory of the striking leg and the rotation of the body parts—ankle, pelvis and torso—while maintaining body balance and orienting the movement toward the target. As repetition is fundamental to learning repetition combined with immediate visual correction increases the speed and quality of learning by enabling the immediate recognition and correction of errors. Therefore using a mirror empowers the learner with greater autonomy and a stronger role in the learning process through self-monitoring of movement. This enhances the learner's internal awareness and improves their kinesthetic understanding, facilitating the development of the necessary motor program for performing the movement and correcting errors.

Theoretically the development in the experimental group that used the mirror in learning can be attributed to the learner's control over his body movements and reliance on the principle of error correction through the integration between the image of the ideal movement model and the movement actually performed. This is something that is not provided by the traditional learning method used by the control group.

Goudini et al. (2019) indicate that feedback that can be controlled by the trainee leads to better learning outcomes and higher motivation indicators among beginner taekwondo practitioners. Visual feedback can also enhance learning by directing attention to the results of a movement through the interaction between what is demanded and what is performed (Kal et al., 2022). Furthermore, visual feedback allows the learner to identify spatial and temporal gaps in the executed movement pattern and then modify them in subsequent repetitions as well as improve pressure points and balance (Vando et al., 2021; Vando et al., 2014). The findings of the study by Han & Ji et al. (2022) indicate that visual feedback supports the learning of complex motor skills better than verbal or traditional training alone.

Conclusions

- Both the traditional method and the mirror-based learning method contributed to constructing the performance level of the back roundhouse kick to the head from the pre-test to the post-test indicating the overall effectiveness of the educational program in learning the skill.



- The experimental group that learned using the mirror reached greater improvement than the control group, suggesting that immediate visual feedback contributed to accelerating skill learning and improving execution accuracy.
- The absence of statistically significant differences between the two groups in the pre-test contrasts with the emergence of statistically significant differences in the post-test in favor of the experimental group. This reinforces the conclusion that the improvement is due to the impact of the experimental variable namely the use of the mirror and not to any prior differences between the two groups.
- The use of the mirror is an effective teaching aid in learning complex motor skills in Taekwondo especially those skills that needed high balance, rotation and precise control of body position during performance.

Recommendations

- It is recommended to incorporate mirrors into the teaching units for basic and complex Taekwondo skills particularly for younger age groups and Taekwondo learners aged 12-14 due to their role in providing direct visual feedback.
- It is recommended to equip training rooms with a suitable visual teaching aids primarily mirrors, to improve motor learning and reduce technical errors during performance.
- Coaches and instructors are recommended to use mirrors systematically and in a planned manner within lessons integrating them with verbal explanations and practical demonstrations to achieve optimal learning outcomes.
- It is recommended to carry out further studies on other Taekwondo skills using larger samples and different age groups and incorporating additional variables such as gender, experience and learning retention, to broaden our understanding of the effect of mirrors on motor learning.



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