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The Effect of Smash Drill Training Using Visual Cues on Quick Smash Tipple Skills in Athletes Aged 15-19 Years

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Abstract

This study aims to analyze the effect of drill smash exercises using visual cues on the improvement of quick smash skills in volleyball athletes aged 15–19 years. The main premise of the study is that the skill of quick smash is determined not only by the repetition of the technique, but also by the athlete's ability to respond to visual stimuli, regulate jump timing, coordinate eye-hand movements, and direct punches accurately. The research uses a quantitative approach with a one group pretest-posttest design. The research sample consisted of six athletes from the Tunas Tugumuda Semarang Volleyball Club who were selected through purposive sampling techniques. Treatment was given in the form of a quick smash drill exercise based on visual cues for 14 meetings. The research instrument used a quick seesaw's smash accuracy test with 10 experiments based on the target zone. Data were analyzed using descriptive statistics, Shapiro-Wilk normality test, paired sample t-test, and effect size. The results of the descriptive analysis showed an increase in the average score from the pretest by 24.50 to 37.83 in the posttest. The normality test showed that the data was distributed normally, so the hypothesis test was carried out using a paired sample t-test. The results of the t-test showed a significant difference between the pretest and the posttest with a p< value of 0.001. In addition, the effect size results showed a huge influence, which indicated that exercise had a strong practical impact on the improvement of athletes' skills. Thus, the research hypothesis is accepted, namely that drill smash exercises using visual cues have a significant effect on improving quick smash skills to jump. These findings suggest that the integration of drill drills and visual cues can be an effective, applicative, and relevant training strategy for the development of attack skills of young volleyball athletes.

Keywords: drill exercises; visual cues; Smash Quick Seesaw; ball; motor skills.

INTRODUCTION

Volleyball is a game sport that demands the integration of technical skills, physical condition, neuromuscular coordination, perceptual accuracy, and quick decision-making. In the modern game, the team's success is not only determined by mastery of basic techniques such as serves, passing, blocks, and smash, but also by the athlete's ability to execute technical actions under time pressure and rapidly changing game situations. Various studies confirm that the performance of net and ball-based sports is greatly influenced by the quality of movement coordination, attack efficiency, set quality, punch position, and the ability of athletes to read visual information before performing motor actions (Adamec & Přidal, 2024; Fatahi et al., 2022; López et al., 2024; Mocanu et al., 2024a). In the context of volleyball, smash is one of the main attack techniques because it plays a direct role in generating points and pressuring the opponent's defense. Therefore, the development of adolescent athletes needs to be directed at mastering attack skills systematically, especially in fast smash techniques that require coordination, timing, reaction, and high accuracy.

One of the important variations of attack techniques in volleyball is the quick seesaw. This technique is done with a fast tempo, relatively low pass, and short jump and punch times. These characteristics demand good synchronization between tosser and spiker, the ability to read the direction of the ball, the accuracy of determining the timing of the reject, and the ability to direct the shot to the target effectively. However, in athletes aged 15–19 years, this skill often does not

develop optimally due to limited experience, low technical stability, lack of training variety, and not the maximum use of training stimuli that resemble match conditions. Studies on the performance of young athletes show that improving technical skills is not enough just through the repetition of movements, but needs to involve the quality of training, perceptual abilities, information processing, and adaptation to situational stimuli (Costa et al., 2025; Pawlik et al., 2022; Rifki et al., 2025). This problem is important because smash quick somersaults are not just ball-hitting movements, but complex skills that combine visual, cognitive, coordinative, and motor aspects.

The sports literature shows that drill-based exercises are still one of the important approaches in the formation of engineering skills because they can provide repetition, correction, and stabilization of movement patterns. Structured repetitions can strengthen movement automation, improve technique consistency, and help athletes build more efficient movement control. However, the development of motor learning research confirms that technical training will be more effective if it not only focuses on mechanical reps but also involves sensory information and stimuli that help athletes make decisions faster. Research on task instruction in motor training shows that the provision of appropriate instruction and stimuli can improve performance and modulate attention networks during exercise (Penalver-Andres et al., 2021). Other findings also show that the use of visual cues, graphic cues, action observation, and multisensory training can help improve working memory, anticipation, movement response, and tactical understanding in sports (J. Jang et al., 2024; Mezghanni et al., 2022; Wang et al., 2025).

In sports that demand reaction speed, visual information plays a central role because athletes must identify the opponent's movement, ball direction, free space, and attack momentum in a short period of time. Studies of eye-tracking and visual behavior in sports show that visual attention quality, vision patterns, and the ability to anticipate movement are important components of athlete performance (Alemanno et al., 2025; Espino Palma et al., 2023; Ivosevic & Stöckel, 2025). In basketball, visual timing has been shown to be related to shot success, while in racquet sports and invasion games, visual and multisensory stimulation are associated with accuracy, reactive agility, and decision-making (López-Sierra et al., 2025; Piras, 2024). Thus, the use of visual cues in smash training could potentially help athletes associate visual information with more precise motor responses.

Visual cue-based drill smash exercises can be seen as an integrative solution because they combine the repetition of the technique with visual stimuli that demand the athlete to respond quickly and in a directed manner. Through this approach, athletes not only repeat smash motion patterns, but also learn to adjust the prefix, repulsion, timing, ball contact, and stroke direction based on the visual stimuli given. The strategy is in line with an ecological-dynamic approach that emphasizes that sports skills develop through interactions between individuals, tasks, and the training environment (Costa et al., 2025; Montalt-García et al., 2023). In the context of technique training, the integration of visual information is also relevant to the need to improve eye-hand coordination, perception of the direction of the ball, as well as the effectiveness of attack actions.

However, there are still research gaps. Most previous studies have focused more on match performance, tactical analysis, eye-tracking, analytical technology, or other sports skills such as basketball, badminton, soccer, tennis, padel, and fencing (Alemanno et al., 2025; Mahajan et al., 2025; Malawski, 2022; Perri et al., 2022; Weerasinghe et al., 2025). In volleyball, many studies have highlighted attack quality, serve-receive relationship with attack performance, setter position, and validation of technical instruments (Adamec & Přidal, 2024; Fatahi et al., 2022; López et al.,

2024; Rifki et al., 2025). However, experimental studies that specifically test drill smash exercises using visual cues on quick smash skills in adolescent athletes are still limited. This gap shows the need for research that tests the effectiveness of exercises that are practical, easy for trainers to apply, and in accordance with the developmental characteristics of athletes aged 15–19 years.

Based on this background, this study aims to analyze the effect of drill smash exercises using visual cues on the improvement of quick somersault smash skills in volleyball athletes aged 15–19 years at Club Tunas Tugumuda Semarang. The novelty of this study lies in the application of drill exercises combined with visual cues as a perceptual-motor stimulus to improve quick somersault smash skills, especially in adolescent athletes. Different from conventional drill exercises that emphasize movement repetition, this approach integrates technique repetition with visual stimuli to train response speed, eye-hand coordination, timing accuracy, and stroke accuracy. The scope of the study was limited to one group of athletes with a one-group pretest-posttest design, training treatment for 14 meetings, and skill measurement through a quick somersault smash accuracy test. The results of the study are expected to make a practical contribution for coaches in designing a more contextual, adaptive, and visual information-based attack training program for the development of young volleyball athletes.

METHODS

Research Design

This study uses a quantitative approach with a pseudo-experiment method through a one-group pretest-posttest design. This design was chosen because the study aimed to determine changes in quick somersault smash skills before and after being treated in the form of drill smash exercises using visual cues. In this design, the research subjects are first given an initial test or pretest, then follow an exercise program, and then be given a final test or posttest. The difference in score between the pretest and posttest was used as the basis for assessing the effectiveness of the treatment. The pretest-posttest design is relevant in sports training research because it can provide an overview of changes in participants' performance after participating in a structured training intervention. In the context of motor learning and training, the use of systematic treatments is important to see changes in the technical ability, coordination, and movement response of athletes (Penalver-Andres et al., 2021; Wang et al., 2025).

Participants

The population in this study is volleyball athletes of Club Tunas Tugumuda Semarang who are in the adolescent age range. The research sample consisted of six athletes aged 15–19 years who were selected using purposive sampling techniques. This technique is used because the researcher sets certain criteria according to the research objectives, namely athletes who actively participate in training, are in the age range of 15–19 years, have basic experience in volleyball, and are willing to follow the entire series of treatments and measurements. This age range was chosen because adolescence is an important phase in the development of sports technique skills, movement coordination, and adaptability to exercise stimuli. In volleyball, coaching techniques at a young age is important because the quality of basic and attacking skills plays a role in the effectiveness of game performance (Fatahi et al., 2022; Rifki et al., 2025).

Research Variables

This study consists of two main variables. The free variable is a smash drill exercise using visual cues, while the bound variable is a quick somersault smash skill. Drill smash exercises using

visual cues are defined as smash technique exercises that are performed in a repetitive, structured manner, and combined with visual stimuli to help athletes determine timing, direction of movement, and stroke response. The quick smash of the somersault skill is defined as the ability of an athlete to perform a quick attack through a series of starts, repulsions, punches, and landings with good target accuracy. The use of visual cues in exercise is based on the importance of visual information in exercise that requires quick reactions, anticipation, and coordination of movements (Alemanno et al., 2025; D. Jang & Ha, 2024; Mezghanni et al., 2022).

Instrument and Measurement

The instrument used in this study was the precision test of the quick somersault smash. The test is carried out by giving each athlete the opportunity to perform 10 smash attempts to a predetermined target area. Each shot is scored based on the accuracy with which the ball reaches the target zone. The total score of 10 attempts is used as the value of the quick somersault smash skill. Measurements were carried out twice, namely before treatment as a pretest and after treatment as a posttest. The test implementation involves the testor to ensure that the measurement procedure runs consistently. The equipment used includes volleyball courts, volleyballs, nets, whistles, stopwatches, scoresheets, and target areas. The use of performance-based instruments is important in sports research because engineering skills need to be measured through motion tasks that match the characteristics of the sport. This is in line with volleyball technique evaluation research that emphasizes the importance of instruments that are valid, reliable, and in accordance with the specific skills being measured (Rifki et al., 2025).

Intervention Procedure

The treatment in this study was in the form of a quick somersault drill smash training program using visual cues which was carried out for 14 meetings in one month. Each training session consists of three main parts, namely warm-up, core training, and cool-down. In the warm-up stage, athletes perform stretching activities and basic movements to prepare for the body's condition. In the core exercise, athletes perform a quick smash drill repeatedly with the help of visual cues. Visual cues are used to direct the athlete's attention to the starting moment, jump timing, ball direction, and hit target. The exercises are carried out gradually from simple patterns to patterns that more closely resemble game situations. In the cool-down stage, athletes perform light movements to reduce the intensity of activity. This approach is designed so that athletes not only repeat movements mechanically but also learn to connect visual stimuli with motor decisions. In the sports training literature, the integration of visual stimuli, instruction, and repetition of movements can support improved attention, anticipation, and quality of motor responses (Espino Palma et al., 2023; Ivosevic & Stöckel, 2025; Wang et al., 2025).

Data Collection Procedure

The data collection procedure begins with giving a pretest to all samples to determine the initial ability of the quick somersault smash skill. After the pretest, athletes take part in a visual cue-based drill smash training program according to a predetermined schedule. After the entire treatment session is completed, the researcher provides a posttest with the same procedures, instruments, and measurement conditions as the pretest. Uniformity of measurement procedures is carried out to maintain data consistency and minimize measurement bias. All scores are recorded in an observation sheet, then recapitulated for statistical analysis.

Data Analysis

Data analysis is carried out through several stages. First, descriptive statistical analysis is used to describe the minimum, maximum, mean, standard deviation, and pretest and posttest score ranges. Second, the normality test was carried out using Shapiro-Wilk because the sample count was less than 50. The data is declared to be normally distributed if the significance value is greater than 0.05. Third, if the assumption of normality is met, hypothesis testing is carried out using a paired sample t-test to find out the difference in pretest and posttest scores. The significance level used is 0.05. Fourth, the study also reported the effect size using Cohen's d and Hedges' correction to determine the effect of the treatment in practice. Effect size reporting is important in sports intervention research because statistical significance alone is not enough to explain the strength of the performance changes that occur. Thus, a combination of descriptive analysis, assumption test, difference test, and effect size was used to provide a more comprehensive interpretation of the results and in accordance with the standards of scientific publications.

RESULTS

The results are presented to show changes in quick jungkit smash performance after 14 sessions of drill smash training using visual cues. The interpretation of the results focuses on three main indicators: descriptive changes in pre-test and post-test scores, statistical differences between the two measurements, and the practical magnitude of the intervention effect. This structure is relevant because volleyball attack performance is influenced by the interaction between technique, set quality, reception quality, movement coordination, and sport-specific assessment procedures (Adamec & Přidal, 2024; Fatahi et al., 2022; López et al., 2024; Mocanu et al., 2024a, 2024b; Wibowo & Wicaksono, 2024).

Descriptive analysis was conducted on six volleyball athletes aged 15–19 years who completed the pre-test, 14 training sessions, and post-test. As shown in Table 1, the mean quick jungkit smash score increased from 24.50 ± 4.889 in the pre-test to 37.83 ± 4.309 in the post-test. The gain of 13.33 points, or approximately 54.41% relative to the pre-test mean, indicates a substantial improvement after the visual cue-based drill intervention. The total group score also increased from 147.0 to 227.0, showing that the improvement was not limited to a single participant but occurred at the group level. In training contexts, this pattern is consistent with evidence that structured technical repetition, task instruction, and training media can strengthen movement consistency, learning quality, and skill acquisition in young athletes (Alim & Yuliarto, 2022; Chaeroni & Surur, 2023; J. Jang et al., 2024; Penalver-Andres et al., 2021; Tan et al., 2024).

Tabel 1. Descriptive and normality test result

	Quick Jungkit Smash Pre-test	Quick Jungkit Smash Post-test
Valid	6	6
Missing	0	0
Mean	24.50	37.83
Std. Deviation	4.889	4.309
Shapiro-Wilk	0.941	0.858
P-value of Shapiro-Wilk	.667	.182
Range	13.00	10.00
Minimum	17.00	33.00
Maximum	30.00	43.00
Sum	147.0	227.0

The minimum score increased from 17.00 in the pre-test to 33.00 in the post-test, while the maximum score increased from 30.00 to 43.00. These changes show that athletes with lower and higher initial abilities both benefited from the intervention. The score range also decreased from 13.00 to 10.00, indicating a more compact post-test distribution. From a performance interpretation perspective, this result suggests that repeated quick smash drills supported by visual cues may help athletes stabilize the approach, jump timing, ball contact, and target direction. Such an interpretation is supported by studies emphasizing the role of lower-extremity power, movement positioning, serve-reception ability, and repeated sport-specific training in volleyball performance development (Ardha et al., 2023; Sato et al., 2024). The Shapiro-Wilk values were 0.941 for the pre-test and 0.858 for the post-test, with p values of 0.667 and 0.182, respectively. Because both p values were greater than 0.05, the data were normally distributed, allowing the use of a paired-sample t-test. The use of performance-based measurement is also aligned with sport-skill assessment research that emphasizes valid, contextual, and technique-specific testing procedures (Alexander & Kustiawan, 2024; Ngatman et al., 2024).

The paired-sample t-test was used to determine whether the difference between pre-test and post-test scores was statistically significant. As presented in Table 2, the mean paired difference was -13.33333 because the calculation was performed by subtracting the post-test score from the pre-test score. The t value was -13.047 with 5 degrees of freedom, and the two-sided significance value was < .001. These findings show that drill smash training using visual cues produced a significant improvement in quick jungkit smash performance. The result is consistent with the view that visual information, graphic cues, visual attention, and multisensory stimulation can improve anticipation, decision-making, eye-hand coordination, and motor response accuracy in fast sport situations (Rassam et al., 2024; Vera et al., 2026).

Table 2. Paired sample test result

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Quick Jungkit Smash Pretest - Quick Jungkit Smash Posttest	-13.33333	2.50333	1.02198	-15.96042	-10.70625	-13.047	5	<.001	<.001

The 95% confidence interval of the mean difference ranged from -15.96042 to -10.70625 and did not cross zero. This interval confirms that the increase in post-test scores was stable and unlikely to be explained by random variation alone. Substantively, the result indicates that visual cue-based

drills created a clearer connection between the athlete's perception of the stimulus and the execution of the smash movement. Similar mechanisms have been reported in studies on visual behaviour, early pattern recognition, tactical cue use, and sensorimotor adaptation, where athletes' ability to read stimuli and organize movement responses contributes to more effective performance (Díaz-García et al., 2024; Ivosevic & Stöckel, 2025).

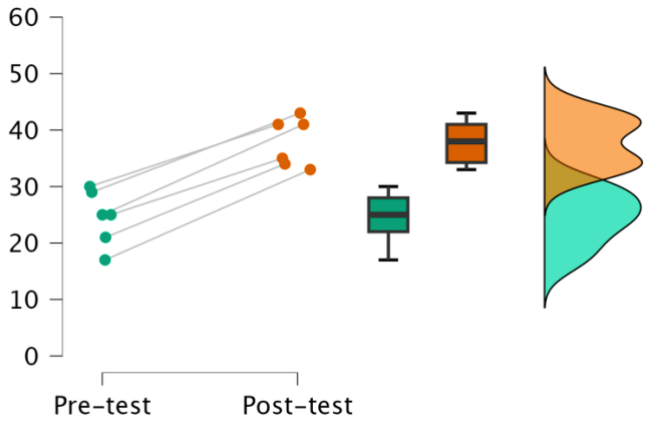

Figure 1. Comparation pre and post test result

Figure 1 strengthens the statistical findings by showing the direction of change for each athlete and the distribution shift between the two measurements. The individual lines indicate that all athletes improved from pre-test to post-test, while the boxplot and density display show that the post-test scores were positioned at a higher level than the pre-test scores. This visual pattern supports the conclusion that improvement occurred consistently across participants rather than only through an increase in the group mean. In sport-performance studies, the use of visualized data, match analytics, tracking, and technology-supported observation is useful for interpreting changes in movement quality and technical performance (Accornero et al., 2025; Mahajan et al., 2025; Ramachandran et al., 2021).

In addition to statistical significance, effect size was calculated to determine the practical strength of the intervention. As shown in Table 3, Cohen's d was -5.326 and Hedges' correction was -4.478. The negative direction occurred because the score difference was calculated as pre-test minus post-test; therefore, the negative value substantively indicates that the post-test score was higher than the pre-test score. Based on the absolute value, the effect size was very large. This finding suggests that the intervention did not merely produce a statistically detectable change but also generated a meaningful practical improvement in athlete performance. Such a result is relevant to studies showing that contextual training, ecological-dynamic learning, and coordinated perceptual-motor tasks can enhance sport-skill development (Anwar et al., 2024; Montalt-García et al., 2023).

Table 3. Effect size result

			Standardizer[a]	Point Estimate	95% Confidence Interval	
					Lower	Upper
Pair 1	Quick Jungkit Smash Pretest – Quick Jungkit Smash Posttest	Cohen's d	2.50333	-5.326	-8.618	-2.053
		Hedges' correction	2.97750	-4.478	-7.246	-1.726

a. The denominator used in estimating the effect sizes.
Cohen's d uses the sample standard deviation of the mean difference.
Hedges' correction uses the sample standard deviation of the mean difference, plus a correction factor.

The very large effect size indicates that drill smash training using visual cues had a strong practical influence on quick jungkit smash skill. In practical terms, the athletes appeared to benefit from the combination of repeated smash execution and visual stimuli that directed attention to the approach phase, jump timing, ball trajectory, contact point, and target area. This finding supports the role of cue-based learning and sensory information in improving technical execution, especially in skills requiring rapid perception-action coupling (D. Jang & Ha, 2024; Vera et al., 2026; Wang et al., 2025).

Overall, the results demonstrate that visual cue-based drill smash training was effective in improving quick jungkit smash skills among volleyball athletes aged 15–19 years. The evidence is shown by the increase in mean score, improvement in minimum and maximum scores, normal distribution of data, significant paired-sample t-test result, consistent individual improvement in Figure 1, and very large effect size. These findings support the use of visual cues as a simple and applicable training stimulus for developing quick attack skills because it links technical repetition with attention control, anticipation, movement coordination, and target accuracy. The result also expands previous volleyball and net-game research that has mainly focused on match analysis, attack indicators, player tracking, feedback technology, and technique evaluation rather than direct visual cue-based drill intervention (López et al., 2024; Mocanu et al., 2024b, 2024a).

DISCUSSION

The findings of this study show that drill smash exercises using visual cues make a positive contribution to improving quick smash skills in volleyball athletes aged 15–19 years. Rationally, the increase can be explained through the characteristics of the exercise that combine the repetition of the technique with visual stimulus as a trigger for the movement response. Smash quick somersault is a quick attack skill that requires athletes to integrate visual perception, jump timing, eye-hand coordination, stroke direction, and body control in a very short amount of time. Therefore, exercises that focus only on mechanical reps are not entirely enough to develop this skill.

Visual cues help athletes' direct attention to key moments in the execution of movements, such as reading the direction of the ball, adjusting the prefix, determining the timing of the push, and directing the shot. In this context, skill enhancement can be understood as the result of perceptual-motor adaptations that occur through repetitive and structured exercise. These findings are in line with the view that the performance of game sports is influenced by the interaction between technical ability, visual information, decision-making, and movement coordination (Costa et al., 2025; Montalt-García et al., 2023; Penalver-Andres et al., 2021).

The results of this study are supported by several previous studies that show the importance of visual information and structured exercises in improving exercise skills. Penalver-Andres et al. (2021) explain that giving task instructions during motor training can improve performance and modulate attention networks. The findings are relevant to visual cue-based drill exercises because athletes not only repeat the movement but also receive stimuli that direct the focus of attention to a specific component of the movement. Mezghanni et al. (2022) also found that coordination between visual cues and verbal cues can improve tactical learning in sports, suggesting that visual stimuli are able to help athletes understand game situations more effectively.

Other support comes from research on visual behavior and anticipation in sports. Alemanno et al. (2025) assert that eye-tracking can explain how vision patterns relate to performance in the sport of basketball. Espino Palma et al (2023) showed that expert athletes use certain visual strategies when

playing on the field, while Ivosevic and Stöckel (2025) found that skilled players benefit from earlier pattern recognition in football situations. Although the sport is different, the principle is relevant to volleyball because quick smash somserk also requires quick identification of the opponent's pass pattern, ball direction, and defensive gaps.

In the context of volleyball, Fatahi et al. (2022) show that the quality of reception, set zones, and attack quality are closely related in the performance of high-level players. López et al. (2024) emphasized the importance of the role of setters in building attacks, while Adamec and Přidal (2024) showed the relationship between serve-receive quality and attack performance across different age categories. Mocanu et al. (2024b) also emphasized that attack indicators in volleyball differ according to positional status and game level. The findings reinforce the study's findings that improved smash skills are inseparable from the quality of timing, coordination, and response to game situations.

However, there are some differences with previous research. Most previous studies have focused more on match analysis, tactical performance, tracking technology, or technique evaluation, rather than on direct visual drill interventions (Accornero et al., 2025; Nako et al., 2025; Ramachandran et al., 2021). Other research in racket sports, such as padel, tennis, and badminton, has more discussed hitting accuracy, impact position, decision tree, or visual stimulation in different game contexts (D. Jang & Ha, 2024; López-Sierra et al., 2025; Sánchez-Alcaraz et al., 2021; Wang et al., 2025). Thus, this study expands the empirical evidence in the context of volleyball, specifically the practice of quick somersault smash in adolescent athletes.

Theoretically, the results of this study can be explained through the perspective of motor learning and an ecological-dynamic approach. Motor learning emphasizes that skills develop through repetitive practice, feedback, reinforcement of movement patterns, and adaptation to the demands of tasks. Drill exercises provide space for the athlete to establish movement stability, while visual cues enrich the process of perception and decision-making. Tan et al. (2024) explain that the involvement of the cerebellar and basal ganglia systems plays a role in improving expertise in sensorimotor adaptation tasks. This supports the interpretation that repetitive exercise combined with visual stimuli can strengthen coordination between perception and action.

The ecological-dynamic approach places sports skills as the result of the interaction between athletes, tasks, and the environment. Costa et al. (2025) show that cognitive and ecological-dynamic approaches are relevant in the development of volleyball skills at a young age. Montalt-García et al. (2023) also emphasized the importance of integrating cognitive performance into motor competency assessments. In this study, visual cues act as environmental constraints that direct athletes to adapt motor actions to training situations. Thus, these exercises not only improve technique, but also help athletes develop the adaptive abilities needed in real games.

From the perspective of adolescent athlete development, the age of 15–19 years is an important phase to strengthen sport-specific skills. In this phase, athletes begin to need more complex, contextual, and close-up training to match situations. Pawlik et al. (2022) show that physical ability and receiving efficiency in young volleyball athletes are related to game performance. Bobula et al. (2024) emphasize the importance of power, movement, position, and effectiveness of the lower extremities in volleyball. Ardha et al. (2023) also affirmed that certain physical exercises can increase the power of the lower extremities of volleyball athletes. Thus, the increase in smash quick seesaws can be understood as the result of the interaction between technique training, visual response, movement coordination, and physical readiness of athletes.

Practically, the results of this study provide direction for volleyball coaches that the smash quick somersault training should not only be done through the repetition of punches but also needs to be combined with visual stimuli that direct the athlete's attention and response. Coaches can use color markers, hand gesture directions, target targets, pass variations, or other visual cues to practice smash timing, coordination, and accuracy. This approach can help athletes adapt their movements to situations closer to the game, so that the skills developed are not static, but adaptive.

Visual cue-based drill exercises can also be applied gradually, ranging from simple patterns to more complex patterns. In the early stages, the coach can emphasize the consistency of the start, reject, and contact of the ball. In the next stage, visual stimuli can be varied to train decision-making, stroke direction, and response to changing situations. This strategy is relevant to the needs of modern coaching that is beginning to utilize data, visualization, and technology to improve the quality of training (Accornero et al., 2025; Nako et al., 2025; Weerasinghe et al., 2025). For young volleyball clubs, this approach can be a simple, inexpensive, and easy-to-implement training alternative without the need for complex technological devices. Thus, drill smash exercises using visual cues have the potential to increase the effectiveness of attacking skill development, especially in adolescent athletes who are in the phase of strengthening sports-specific techniques.

CONCLUSION

Exercises that combine technique repetition with visual stimulus have been shown to help athletes improve coordination of movement, regulate jump timing, improve the accuracy of responses to the direction of the ball, and direct shots to the target more accurately. The findings of this study show that there are differences in quick smash skills before and after being given drill smash exercises using visual cues. Thus, visual cue-based exercises are not only statistically effective but also have practical significance in the process of coaching young athletes' attacking skills. The use of visual cues allows athletes to not only mechanically repeat movements, but also to train the ability to read stimuli, make quick decisions, and adapt movements to game situations. Applicatively, this training model can be used as an alternative training strategy for volleyball coaches, especially in developing fast smash skills in adolescent athletes. Coaches can integrate visual markers, target variations, or directional signals in drill exercises to make the practice process more contextual and closer to the match situation. However, this study has limitations on the relatively small number of samples and the use of a single-group design without a control group. Therefore, further research is recommended to involve a larger number of participants, using comparison groups, as well as testing the effectiveness of these exercises in different age categories, skill levels, and match situations.

RECOMMENDATION

Based on the results of the study, smash drill exercises using visual cues are recommended to be applied in the coaching program of young volleyball athletes, especially in improving quick somersault smash skills. Coaches can use this approach as a variation of attack technique training because the exercises not only emphasize the repetition of movements, but also train the athlete to read visual stimuli, set the timing, and adjust the direction of the shot to the target. In its application, coaches are advised to arrange exercises gradually, starting from simple drills to more complex forms of exercises that resemble match situations. Visual cues can be provided through color markers, the direction of the coach's hand, variations in the target position, changes in the direction of the pass, or other stimuli that are easy for the athlete to observe. Exercises also need to be done consistently so

that athletes can form stable movement patterns and faster responses. For athletes, this exercise can be used to improve focus, eye-hand coordination, reaction speed, and punch accuracy. Athletes are expected to follow each training session with discipline, pay attention to the stimulus given, and evaluate technical errors after training. For subsequent researchers, it is recommended to develop a study with a larger sample size, involving a control group, as well as test these exercises on different age categories and skill levels. Further research can also add other variables, such as leg muscle explosiveness, eye-hand coordination, concentration, reaction speed, or smash effectiveness in actual match situations. Thus, the results of future research can provide stronger and broader evidence regarding the effectiveness of visual cue-based drill smash exercises in volleyball coaching.

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