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# An Experimental Study of the Effects of Command and Reciprocal Teaching Styles on the Development of Motor Response Speed and Interactive Behavior among School Volleyball Players in Diyala Province

Muslim Dheyab. Mohammed Al-Afrajee[1], Hossein. Khanifar[2*], Hussein Ali. Hussein[3]

[1] Ph.D. Student in Educational Management, Aras International Campus, University of Tehran, Tehran, Iran
[2] Professor, Department of Management and Planning, Farabi Campus, University of Tehran, Tehran, Iran
[3] Lecturer, College of Physical Education and Sports Sciences, University of Diyala, Diyala, Iraq

*** Corresponding author email address**: Khanifar@ut.ac.ir

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A B S T R A C T

This study aimed to compare the effects of command and reciprocal teaching styles on motor response speed and interactive behavior among male school volleyball players in Diyala Province. The study employed a two-group pretest–posttest experimental design. The participants were 24 male volleyball players selected from intermediate and secondary school teams affiliated with the Directorate-General of Education in Diyala Province during the 2026 academic year and randomly assigned to a command-style group (n = 12) or a reciprocal-style group (n = 12). Both groups completed a standardized eight-week instructional program consisting of two 45-minute sessions per week, for a total of 16 sessions. The experimental manipulation was applied during the 25-minute main practical component of each session. Motor response speed was measured using an electronic ChronoJump-based reaction and movement timing system, while interactive behavior was assessed through structured observation of communication, cooperation, peer feedback, and task-related interpersonal behaviors. Data were analyzed in SPSS version 26 using descriptive statistics, independent-samples t tests, assumption testing, analysis of covariance, and adjusted pairwise comparisons at an alpha level of .05. ANCOVA revealed a significant effect of teaching style on motor response speed after controlling for pretest scores, $F(1, 21) = 7.49$, $p = .012$, partial $\eta^2 = .263$. Adjusted posttest comparisons showed significantly faster motor responses in the command-style group than in the reciprocal-style group (0.971 vs. 1.049 s, $p = .012$). Teaching style also had a significant effect on interactive behavior, $F(1, 21) = 31.22$, $p < .001$, partial $\eta^2 = .598$. The reciprocal-style group achieved a significantly higher adjusted interactive behavior score than the command-style group (41.03 vs. 34.72, $p < .001$). The command teaching style was more effective for improving motor response speed, whereas the reciprocal teaching style was more effective for developing interactive behavior, indicating that instructional methods should be selected according to the specific motor and social objectives of school volleyball training.

***Keywords:*** *Command Teaching Style; Reciprocal Teaching Style; Motor Response Speed; Interactive Behavior; Volleyball; School Athletes*

## 1. Introduction

Physical education and school sport occupy an important position in the development of students' physical competence, motor efficiency, cognitive engagement, and social behavior. Within this context, the effectiveness of instruction depends not only on the content being taught but also on the pedagogical method through which learners interact with that content. Teaching style determines the distribution of decisions between teacher and learner, the organization of practice, the nature of feedback, and the extent to which students are given responsibility for observing, evaluating, and modifying performance. Contemporary physical education research increasingly emphasizes that instructional methods should be selected according to the intended learning outcomes rather than applied as fixed or interchangeable procedures, because different styles may generate different motor, cognitive, affective, and social consequences (1-4). This issue is especially relevant in school volleyball, where successful performance depends on the simultaneous development of rapid motor responses, technically efficient movement patterns, decision-making under changing conditions, and coordinated interaction with teammates.

The spectrum of teaching styles provides one of the most influential frameworks for examining instructional decision-making in physical education. Within this framework, styles vary according to who makes decisions regarding task organization, execution, feedback, evaluation, and progression. Teacher-centered styles place greater control in the hands of the instructor, whereas learner-centered styles progressively transfer selected decisions to students. The command style represents one of the most teacher-directed approaches, characterized by precise instructor control over timing, movement sequence, repetition, pace, and feedback. In contrast, the reciprocal style transfers part of the feedback and observational process to learners working in pairs, with one student performing and another observing performance according to explicit criteria before the partners exchange roles. This distinction is pedagogically important because the command style emphasizes immediate compliance, execution consistency, and direct correction, whereas the reciprocal style emphasizes observation, peer communication, feedback exchange, responsibility, and interpersonal learning (2, 3, 5).

Research on teaching styles has demonstrated that pedagogical organization can influence both motor performance and psychological or behavioral outcomes. Students exposed to different instructional structures do not simply receive the same motor information through different delivery channels; rather, they experience different cognitive demands, levels of autonomy, social responsibilities, and patterns of feedback. Kolovelonis and Syrmpas, for example, highlighted differences across command, practice, and self-check styles in relation to inhibition, cognitive flexibility, and performance calibration, suggesting that the structure of instructional decision-making may influence executive and self-regulatory processes in addition to observable skill performance (5). Similarly, research examining affective and cognitive motivation has demonstrated that teaching style can alter how learners engage with physical education activities and how they respond psychologically to instructional environments (6). These findings reinforce the need to examine instructional style not merely as a technical teaching preference but as an independent variable capable of shaping multiple dimensions of learning.

The command teaching style remains particularly relevant in sport instruction because of its capacity to organize large groups efficiently, standardize technical execution, and provide immediate corrective feedback. In highly structured motor tasks, direct instruction can reduce uncertainty by making the expected movement pattern explicit and by allowing the teacher to intervene rapidly when errors occur. This may be advantageous in volleyball, where defensive posture, movement direction, platform orientation, and response timing must often be corrected within fractions of a second. The pedagogical value of direct and structured instruction has also been discussed within volleyball-specific literature, where technical competence depends on carefully sequenced practice, repeated execution, and accurate feedback (7, 8). Studies involving drill-based approaches likewise indicate that repetition and structured technical practice can improve basic volleyball skills when the exercises are appropriately organized and linked to clearly defined performance objectives (9, 10).

At the same time, excessive reliance on direct teacher control may limit opportunities for students to analyze performance independently, communicate with peers, and


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develop responsibility for the learning process. Contemporary pedagogical approaches increasingly emphasize that effective sport education should not be reduced to the reproduction of ideal movement patterns but should also encourage perception, adaptation, reflection, and interpersonal engagement. Research on teaching beliefs has shown that coaches and teachers frequently hold assumptions about how sport should be taught, and these beliefs shape the extent to which instruction becomes teacher-dominated or learner-oriented (11). Educational interventions with sport coaches have further demonstrated that exposure to learner-centered pedagogical perspectives can alter both instructional beliefs and actual coaching practices (12). These observations suggest that the choice between a command-oriented and a reciprocal instructional environment may produce meaningful differences not only in technical development but also in the social organization of learning.

The reciprocal teaching style is particularly relevant to this broader conception of physical education because it embeds structured peer interaction within the instructional process. In reciprocal learning, students alternate between performer and observer roles, use predetermined criteria to evaluate performance, and communicate corrective or reinforcing information to one another. Such an arrangement may strengthen students' capacity to observe, interpret, verbalize, and regulate movement while simultaneously increasing opportunities for cooperation and constructive communication. Research in volleyball has reported positive effects of reciprocal teaching on learning processes and sport-specific skill outcomes. Pujianto and Insanistyo found that the reciprocal style could improve the instructional process in volleyball courses, while Riyadi and colleagues reported beneficial effects of reciprocal teaching on underhand passing performance (13, 14). Experimental evidence has also directly compared command and reciprocal teaching styles in volleyball service instruction, indicating that both approaches can influence learning outcomes but may do so through different instructional mechanisms (15).

The pedagogical relevance of reciprocal learning extends beyond technical performance. Because students must observe a partner, identify errors, provide feedback, receive feedback, and subsequently exchange roles, the method inherently creates repeated occasions for interaction. Such experiences may foster communication competence, social responsibility, mutual trust, and sensitivity to the performance needs of others. Heuristic and learner-engaged methods in physical education have been associated with improvements in teamwork and with broader educational outcomes that cannot be captured solely through technical skill tests (16). At the same time, critical discussions of heuristic learning caution that learner-centered strategies require carefully structured tasks and appropriate teacher guidance if students are to construct useful feedback rather than reinforce inaccurate interpretations (17). The reciprocal style therefore should not be interpreted as the withdrawal of the teacher; instead, effective implementation requires the teacher to guide observers, establish clear criteria, and monitor the quality of peer-generated feedback.

Recent developments have further expanded the reciprocal teaching concept by integrating digital and technology-mediated feedback into peer-oriented learning structures. Digital support may increase the accessibility, clarity, and immediacy of corrective information while preserving the learner-centered structure of reciprocal instruction. Research using digital feedback within reciprocal teaching has shown that structured technological support can contribute to the development of fundamental sport skills and positive learner attitudes (18). Although such technological extensions are relatively recent, they reinforce the broader principle that feedback does not need to flow exclusively from teacher to performer. Rather, when students are provided with suitable criteria, task cards, digital support, or guided questioning, they can become active participants in the feedback process itself.

Volleyball offers a particularly appropriate setting in which to compare these instructional approaches because the game combines technical skill with extremely rapid perceptual-motor demands. Defensive performance requires players to perceive the direction and speed of an attacking action, select an appropriate response, initiate movement quickly, reposition the body, and execute a technically accurate contact with the ball. Consequently, motor response speed is not a peripheral fitness characteristic but a fundamental determinant of successful defensive action. Reaction and movement processes are influenced by practice organization, attentional demands, perceptual variability,


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and the motor-learning model used during instruction. Research on varied practice has demonstrated that exposure to changing task conditions can positively influence inhibitory control and reaction time among young participants (19). More broadly, motor-learning research emphasizes that the design of practice conditions strongly affects the adaptations that learners develop, and that instructors should consciously consider which model of learning is embedded in a training program (20).

Nonlinear and variable pedagogical perspectives have similarly emphasized the importance of adapting instruction to the dynamic constraints of sport. Volleyball performance rarely occurs through perfectly repeated, identical movements; players must continually adjust to differences in ball trajectory, speed, spatial position, teammate behavior, and opponent action. Nonlinear pedagogy therefore encourages learning environments in which players are exposed to representative and changing task constraints rather than relying exclusively on decontextualized repetition (21, 22). In related work, multisport and varied-practice approaches have been associated with broader motor development and adaptive performance outcomes, suggesting that diversity in practice may enhance the learner's capacity to respond effectively to changing movement demands (23). Similarly, multiteaching approaches combining different instructional styles and active reflection indicate that pedagogical flexibility may support both performance and cognitive engagement (24). These findings suggest that no single teaching style can automatically be considered optimal for every dimension of sport learning.

The development of volleyball skills is also influenced by perceptual-motor coordination. Eye-hand coordination, spatial anticipation, and movement timing are essential for serving, passing, setting, and defensive reception. Training studies have demonstrated that the organization of practice and the learner's coordination capacities interact in determining volleyball skill outcomes (25). Moreover, comparative studies of inclusion, guided discovery, reciprocal, and other teaching styles have shown that pedagogical method can significantly influence the acquisition of volleyball passing and related fundamental skills (14, 26). These results underscore the importance of examining the teaching method itself rather than assuming that improvement is attributable simply to participation in volleyball practice.

Another important issue is the relationship between physical education pedagogy and the development of fundamental movement capacities. Teaching styles that provide different levels of learner decision-making may influence movement learning in different ways. Research involving divergent discovery and practical teaching styles has shown that instructional organization affects the development of fundamental movement skills, indicating that pedagogical structure is closely connected with movement competence (27). Similarly, studies comparing instructional models in volleyball have emphasized the need to align the teaching model with the specific motor skill being developed and with the characteristics of the learners (8). From this perspective, direct instruction may be particularly useful when rapid correction and technical standardization are required, whereas reciprocal instruction may provide additional benefits when learning goals include communication, peer analysis, and shared responsibility.

This distinction becomes especially important when interactive behavior is considered as an explicit outcome of school sport. Volleyball is inherently cooperative within each team, requiring players to communicate, coordinate positional responsibilities, respond to teammates' actions, and maintain collective organization under time pressure. Social support and psychological safety can influence whether players participate confidently, communicate openly, and remain engaged in volleyball environments (28). Interactive behavior is therefore more than a desirable supplementary characteristic; it contributes directly to team functioning and sustained sport participation. A teaching style that systematically requires players to exchange feedback, observe one another, and cooperate in task completion may consequently affect social interaction more strongly than a method in which most communication flows from teacher to student.

The reciprocal style appears particularly relevant to the development of such behaviors because the learning structure itself depends on interpersonal exchange. Students cannot perform the observer role successfully without attending to a teammate, comparing performance with explicit criteria, and communicating observations in a constructive manner. In contrast, the command style may


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provide fewer formal opportunities for peer communication because feedback is centralized in the teacher. Nevertheless, direct teacher-led instruction may offer advantages for rapid motor adjustment, especially when a movement must be corrected immediately and consistently across all participants. The potential trade-off between efficient motor correction and enhanced social interaction is therefore theoretically important and warrants empirical examination.

Existing volleyball studies have largely concentrated on discrete technical outcomes such as passing, serving, or general skill acquisition (10, 14, 15, 26). Although these studies provide valuable evidence regarding instructional effectiveness, fewer investigations have simultaneously examined a rapid perceptual-motor outcome such as motor response speed and a socially oriented outcome such as interactive behavior within the same experimental design. This omission is important because two instructional methods may produce comparable improvement in one domain while generating substantially different effects in another. A method that produces fast, technically precise responses may not necessarily maximize peer interaction, while an approach that stimulates communication and cooperation may not yield the same degree of immediate motor-response efficiency.

Moreover, contemporary research increasingly supports the use of multidimensional criteria when evaluating physical education instruction. Learning should be understood as a combination of motor, cognitive, affective, and social change rather than as a single technical score. The spectrum of teaching styles and models-based approaches provides a useful conceptual basis for this multidimensional interpretation because different styles allocate responsibility and decision-making in systematically different ways (3). Evidence concerning students' intentions to use different teaching styles in their future professional practice also suggests that prospective physical educators recognize the pedagogical value of possessing a repertoire of instructional approaches rather than relying on one fixed method (4). The practical challenge is therefore to identify which styles are most effective for specific learning objectives and populations.

In the context of school volleyball in Diyala Province, this issue has direct educational and training relevance. School teams operate within limited instructional time, heterogeneous learner abilities, and the dual expectation that physical education should improve sport performance while also promoting positive social behavior. Teachers and coaches consequently need evidence regarding whether a highly structured command style or a reciprocal peer-oriented style is more effective for specific outcomes. Comparing these two methods under equivalent instructional duration, standardized testing conditions, and controlled pretest–posttest procedures can provide a clearer understanding of their differential effects. Such evidence may also support more purposeful lesson planning by allowing teachers to select an instructional style according to whether the immediate priority is rapid motor-response development, interactive behavior, or a balanced combination of the two.

Accordingly, the aim of the present study was to experimentally compare the effects of the command and reciprocal teaching styles on the development of motor response speed and interactive behavior among male school volleyball players in Diyala Province.

## 2. Methods and Materials

This study employed an experimental research design to investigate the effects of two teaching styles, namely the command style and the reciprocal style, on the development of motor response speed and interactive behavior among school volleyball players. An experimental approach was considered appropriate because the study sought to determine the causal effects of systematically manipulated instructional methods on specified dependent variables. A two-group pretest–posttest experimental design with matched groups was adopted. This design permitted the researchers to control, as far as practically possible, for initial differences between participants and to distinguish the effects of the instructional interventions from changes that might occur as a consequence of normal development, repeated practice, or other extraneous influences. The first experimental group received instruction through the command teaching style combined with direct instructional intervention, whereas the second experimental group received instruction through the reciprocal teaching style combined with indirect, guided instructional intervention. Both groups completed identical pretest and posttest measurements of the principal dependent variables.


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The target population consisted of male volleyball players representing selected intermediate and secondary schools affiliated with the Directorate-General of Education in Diyala Province during the 2026 academic year. Participants were selected from the core members of the schools' representative volleyball teams. Using a simple random sampling procedure, 24 eligible players were recruited for the main experiment. The participants were subsequently allocated through a closed-lottery procedure into two equal experimental groups of 12 players each. The first group was assigned to the command-style condition, while the second group was assigned to the reciprocal-style condition. All participants were active school volleyball players who were able to participate fully in the instructional and testing procedures throughout the study period.

Before implementation of the experimental program, the comparability of the two groups was examined to minimize the possibility that pre-existing differences would influence the post-intervention results. Homogeneity and equivalence were evaluated in relation to chronological age, height, body mass, training experience, and baseline scores for motor response speed and interactive behavior. Independent-samples t tests were used to compare the groups on the relevant baseline measures. No statistically significant differences were identified between the two groups at the pretest stage, with all significance values exceeding the adopted alpha level of .05. These findings indicated that the two groups began the intervention from statistically comparable baseline conditions and were therefore suitable for examining the differential effects of the two teaching approaches.

Motor response speed was assessed using an integrated electronic timing and sport-performance analysis system based on the ChronoJump platform connected to a computer. The testing configuration incorporated a high-sensitivity ground contact platform on which the player assumed the volleyball defensive ready position, an electronic digital visual-signal unit positioned approximately six meters in front of the participant, and a fixed light-sensitive wall target. The visual device generated unpredictable stimuli differing in direction and visual presentation. Immediately after the appearance of the stimulus, the player was required to remove the foot from the ground contact platform as rapidly as possible and move toward the illuminated target to touch the designated wall sensor. The system recorded reaction time, defined as the interval between presentation of the visual stimulus and removal of the foot from the contact platform, and movement time, defined as the interval between departure from the platform and contact with the designated sensor. Total motor response time was calculated as the sum of reaction time and movement time, thereby providing an objective index of the player's speed in perceiving an external stimulus, initiating movement, and completing the required defensive response. Electronic timing was supplemented by digital stopwatches with an accuracy of 0.01 s when required during field organization and trial verification.

Volleyball-specific defensive performance was evaluated using a standardized field-based defensive reception test designed to reproduce the temporal and spatial demands of defending against a powerful spike. The participant was positioned in the backcourt defensive area, primarily in position 5 or position 1. Controlled powerful spikes were delivered consecutively from position 4 or position 2 of the opposite court either by a mechanical ball-delivery device or by a skilled coach capable of maintaining consistent velocity and trajectory. Each player completed 10 consecutive attempts. Performance on every attempt was scored from 1 to 5 according to the accuracy of the defensive reception and the player's ability to direct the ball at an appropriate height toward a two-meter-diameter target located in the setter's area around position 3. The maximum possible score was therefore 50. This assessment was incorporated to monitor the functional application of rapid defensive movement within a volleyball-specific performance context rather than evaluating response speed exclusively under laboratory-like conditions.

Interactive behavior was assessed through structured observation of behaviors displayed during instructional and practice activities, particularly behaviors involving communication, peer feedback, cooperation, responsiveness to teammates, exchange of performance-related information, and constructive participation in paired or group learning tasks. Particular attention was paid to behaviors that differentiated individual teacher-directed performance from reciprocal peer interaction, including the ability to observe a teammate, communicate corrective information appropriately, respond to peer feedback, coordinate actions


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with another player, and maintain task-focused interpersonal communication. The same operational criteria were applied during the pretest and posttest phases. Because interactive behavior constituted a central dependent variable in the study, observations were conducted under standardized instructional and volleyball-performance situations so that changes could be attributed more confidently to the teaching style rather than to differences in testing context. The observation criteria and recording procedures were established before the main experiment and were applied consistently across both experimental groups.

A standardized volleyball court located in a sports hall affiliated with the Diyala education authorities was used for all testing and intervention sessions. Standard Mikasa V200W volleyballs with comparable inflation pressure and weight were used to standardize ball-related conditions across participants and sessions. Training markers, elastic ropes, and colored measuring tapes were employed to define movement directions, defensive zones, court boundaries, and target areas. A Sony RX100 VII high-speed digital camera capable of recording at 240 frames per second was also used to document body-position angles, footwork sequences, movement initiation, and selected response characteristics during the testing and instructional procedures. The use of the same court, equipment, ball type, measurement arrangement, and technical conditions across pretesting, intervention sessions, and posttesting was intended to reduce measurement variability arising from environmental or equipment-related factors.

The instructional program was developed on the basis of specialized literature concerning physical education teaching styles, volleyball instruction, defensive movement, and motor-response development. The intervention was implemented over eight consecutive weeks, with two instructional sessions conducted each week, yielding a total of 16 sessions for each experimental group. Each session lasted 45 minutes. The main experiment commenced on February 22, 2026, and concluded on April 19, 2026. The duration and organization of the introductory and concluding portions of each instructional unit were kept identical for both groups. Experimental manipulation was restricted to the 25-minute main practical component of each session, which focused on developing motor response speed, defensive footwork, court-defense performance, and the behavioral processes associated with the respective teaching style. Thus, the principal difference between the groups was not the total instructional exposure but the manner in which instructions, corrections, feedback, and interpersonal interaction were organized.

In the command-style intervention, participants received direct teacher-centered instruction accompanied by immediate verbal and visual corrective intervention. At the beginning of the practical activity, the teacher provided a detailed verbal explanation of the required defensive skill and footwork pattern and subsequently demonstrated the desired technical performance. The 12 players were then organized in parallel lines and performed the prescribed movements simultaneously in response to the teacher's commands or whistle signals. The teacher determined the timing of movement initiation, execution, repetition, and termination. Corrective feedback was immediate, explicit, and behaviorally specific. For example, when the teacher observed an excessively high center of gravity during defensive reception, an inappropriate forearm position, or an inefficient footwork pattern, the player was directly instructed to lower the knees, adjust the feet, or stabilize and approximate the forearms. When a recurrent technical error was observed, the teacher could stop the entire group and use direct intervention with interruption of practice to demonstrate the correct movement pattern again, explain the error, and require repeated execution, commonly through five consecutive corrective repetitions. Accordingly, the command condition emphasized teacher control, uniform execution, immediate external correction, and repeated practice under continuous teacher supervision.

In the reciprocal-style intervention, the 12 participants were randomly organized into six pairs, and learning activities were structured around alternating performer and observer roles. Each pair received researcher-prepared technical task cards containing visual illustrations and written performance criteria addressing effective defensive posture, footwork, ball reception, movement toward short balls, and the interactive behaviors expected during peer-based learning. The performer completed a series of approximately 10 repetitions involving defensive reception of spikes and movement to retrieve short or displaced balls, while the observer monitored performance using the task card and recorded relevant observations. Following each


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attempt, the observer provided immediate, respectful, task-specific verbal feedback to the performer. Feedback was expected to acknowledge successful aspects of performance while identifying a specific element requiring correction, such as appropriate footwork combined with a need to improve forearm alignment at ball contact. The roles of performer and observer were alternated systematically so that all players experienced both execution and observation responsibilities.

Teacher intervention in the reciprocal group was deliberately indirect and guided rather than directed primarily toward the performing player. The teacher circulated among the pairs, monitored the quality of peer observation and feedback, and intervened principally by communicating with the observer. When an observer failed to identify an incorrect defensive position or an important technical error, the teacher used guided questioning and referred the observer back to the task-card criteria. For example, instead of directly correcting the performer, the teacher could ask the observer to compare the teammate's foot orientation with the criterion illustrated on the card and then encourage the observer to explain the necessary correction to the performer before the subsequent repetition. This arrangement preserved the essential characteristics of the reciprocal teaching style by transferring part of the observational and feedback responsibility from the teacher to the learners while maintaining instructional control through structured criteria and guided supervision. The protocol was intended not only to improve technical and motor performance but also to create repeated opportunities for communication, mutual observation, constructive feedback, role exchange, cooperation, and sustained peer interaction.

Immediately after completion of the 16 instructional sessions, posttest measurements were conducted for both experimental groups. The final assessments were administered under the same spatial, temporal, technical, and organizational conditions employed during the pretest. The same measurement instruments, court arrangement, volleyballs, electronic devices, test procedures, scoring criteria, and general sequence of assessment were maintained to maximize measurement consistency. Where applicable, the same evaluators and standardized instructions were retained across measurement occasions. This standardization was intended to ensure that observed pretest-to-posttest differences primarily reflected changes associated with the instructional interventions rather than variations in testing conditions.

All raw data were coded, screened, and analyzed using IBM SPSS Statistics, version 26. Descriptive statistics, including means, standard deviations, and other appropriate distributional indices, were calculated to summarize participant characteristics and the pretest and posttest scores for the principal study variables. Prior to the main inferential analyses, the data were examined for the assumptions required for parametric analysis, including normality of score distributions, homogeneity of variance, linearity between the covariate and posttest outcome, and homogeneity of regression slopes where analysis of covariance was applied. Baseline equivalence between the two experimental groups was examined using independent-samples t tests for demographic, training-related, and pretest variables. The primary intervention effects were evaluated using analysis of covariance (ANCOVA), with the relevant posttest score entered as the dependent variable, teaching style as the between-group factor, and the corresponding pretest score entered as the covariate. This approach was selected to statistically adjust post-intervention comparisons for individual differences in baseline performance and thereby provide a more precise estimate of the relative effects of the command and reciprocal teaching styles. Where a significant overall effect was detected, appropriate post hoc comparisons were conducted to clarify the direction and magnitude of differences between adjusted group means. Statistical significance was established at $\alpha = .05$, and the findings were interpreted on the basis of both descriptive changes and inferential comparisons between the two instructional conditions.

## 3. Findings and Results

The final sample consisted of 24 male school volleyball players who completed all stages of the study, with 12 participants in the command-style group and 12 participants in the reciprocal-style group. The participants were comparable in their general demographic and training characteristics. The mean age of the players in the command-style group was 16.42 years (SD = 0.67), compared with 16.50 years (SD = 0.80) in the reciprocal-style group. Mean


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height was 174.83 cm (SD = 5.46) and 175.25 cm (SD = 5.71), respectively, while mean body mass was 66.58 kg (SD = 6.13) and 67.17 kg (SD = 6.46). The average volleyball training experience was 2.83 years (SD = 0.72) in the command-style group and 2.92 years (SD = 0.79) in the reciprocal-style group. Independent-samples t tests indicated no statistically significant differences between the two groups in age, height, body mass, or training experience at baseline (all $p > .05$), confirming that the groups were demographically comparable before implementation of the instructional programs.

**Table 1**

*Descriptive Statistics for Motor Response Speed and Interactive Behavior in the Command and Reciprocal Teaching Groups*

| Variable | Group | Pretest M | Pretest SD | Posttest M | Posttest SD |
|---|---|---|---|---|---|
| Motor response speed (s) | Command style | 1.284 | 0.103 | 0.968 | 0.081 |
| Motor response speed (s) | Reciprocal style | 1.276 | 0.098 | 1.052 | 0.087 |
| Interactive behavior | Command style | 27.42 | 3.18 | 34.58 | 3.06 |
| Interactive behavior | Reciprocal style | 27.75 | 3.31 | 41.17 | 3.43 |

As shown in Table 1, both instructional groups demonstrated improvements from pretest to posttest in the two dependent variables. For motor response speed, where a lower score represented a faster response, the command-style group decreased from a mean of 1.284 s at pretest to 0.968 s at posttest, whereas the reciprocal-style group decreased from 1.276 s to 1.052 s. Thus, although both groups improved, the descriptive results suggested a greater improvement in motor response speed among players trained through the command teaching style. For interactive behavior, the mean score of the command-style group increased from 27.42 to 34.58, while the reciprocal-style group increased from 27.75 to 41.17. The magnitude of this increase was noticeably greater in the reciprocal-style group, indicating that reciprocal learning activities were associated with stronger development of interaction, communication, peer feedback, and cooperative behaviors.

Prior to conducting the analysis of covariance, the statistical assumptions required for ANCOVA were examined. The Shapiro–Wilk test indicated that the distributions of motor response speed and interactive behavior scores did not significantly deviate from normality in either group at the pretest or posttest stages, with all p values greater than .05. Levene's test of equality of error variances was also nonsignificant for motor response speed, $F(1, 22) = 0.41$, $p = .529$, and interactive behavior, $F(1, 22) = 0.36$, $p = .554$, confirming homogeneity of variance between the two groups. Examination of scatterplots supported an approximately linear relationship between pretest and posttest scores for each dependent variable. In addition, the interaction between instructional group and the corresponding pretest covariate was nonsignificant for motor response speed, $F(1, 20) = 0.62$, $p = .440$, and interactive behavior, $F(1, 20) = 0.48$, $p = .497$. Therefore, the assumption of homogeneity of regression slopes was satisfied. Collectively, these findings indicated that the data met the principal assumptions required for ANCOVA.

**Table 2**

*ANCOVA Results for the Effects of Teaching Style on Motor Response Speed and Interactive Behavior*

| Dependent Variable | Source | SS | df | MS | F | p | Partial $\eta^2$ |
|---|---|---|---|---|---|---|---|
| Motor response speed | Pretest | 0.041 | 1 | 0.041 | 7.86 | .011 | .272 |
| | Teaching style | 0.039 | 1 | 0.039 | 7.49 | .012 | .263 |
| | Error | 0.109 | 21 | 0.005 | | | |
| Interactive behavior | Pretest | 71.36 | 1 | 71.36 | 8.92 | .007 | .298 |
| | Teaching style | 249.78 | 1 | 249.78 | 31.22 | < .001 | .598 |
| | Error | 168.02 | 21 | 8.00 | | | |


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The ANCOVA results demonstrated a statistically significant effect of teaching style on both dependent variables after adjustment for corresponding pretest scores. For motor response speed, the effect of teaching style was statistically significant, $F(1, 21) = 7.49$, $p = .012$, partial $\eta^2 = .263$. This effect size indicated that approximately 26.3% of the adjusted posttest variance in motor response speed was associated with the instructional method. The pretest score was also a significant covariate, $F(1, 21) = 7.86$, $p = .011$, indicating that baseline response speed contributed significantly to posttest performance. For interactive behavior, teaching style exerted an even stronger statistically significant effect, $F(1, 21) = 31.22$, $p < .001$, partial $\eta^2 = .598$, indicating that approximately 59.8% of the adjusted variance in posttest interactive behavior was explained by differences between the command and reciprocal instructional approaches. The corresponding pretest score also had a significant effect, $F(1, 21) = 8.92$, $p = .007$. Overall, the results confirmed that the type of instructional intervention significantly influenced both motor response speed and interactive behavior.

**Table 3**

*Post-Hoc Pairwise Comparisons of Adjusted Posttest Means Between the Command and Reciprocal Teaching Groups*

| Variable | Group | Adjusted Mean | SE | Mean Difference | p | 95% CI |
|---|---|---|---|---|---|---|
| Motor response speed (s) | Command style | 0.971 | 0.021 | -0.078 | .012 | [-0.136, -0.020] |
| | Reciprocal style | 1.049 | 0.021 | | | |
| Interactive behavior | Command style | 34.72 | 0.82 | -6.31 | < .001 | [-8.72, -3.90] |
| | Reciprocal style | 41.03 | 0.82 | | | |

The adjusted pairwise comparisons clarified the direction of the statistically significant group effects. For motor response speed, the adjusted posttest mean was 0.971 s for the command-style group compared with 1.049 s for the reciprocal-style group. Because lower response-time values represented faster performance, the command-style group demonstrated significantly better motor response speed than the reciprocal-style group, with an adjusted mean difference of -0.078 s, $p = .012$, 95% CI [-0.136, -0.020]. In contrast, the reciprocal-style group achieved significantly higher adjusted scores for interactive behavior. The adjusted mean for interactive behavior was 41.03 in the reciprocal-style group compared with 34.72 in the command-style group, producing an adjusted mean difference of 6.31 points in favor of the reciprocal teaching style, $p < .001$. These findings indicate a differential pattern of intervention effects: the command teaching style was more effective in accelerating motor responses, whereas the reciprocal teaching style produced substantially greater development in interactive behavior among the school volleyball players.

## 4. Discussion and Conclusion

The present study examined the comparative effects of command and reciprocal teaching styles on motor response speed and interactive behavior among male school volleyball players in Diyala Province. The findings demonstrated that both instructional approaches were associated with improvement from pretest to posttest, but the pattern of improvement differed according to the outcome examined. After controlling for pretest differences through analysis of covariance, the command-style group achieved significantly better motor response speed than the reciprocal-style group, whereas the reciprocal-style group demonstrated significantly higher interactive behavior. These results indicate that the pedagogical organization of practice can produce outcome-specific effects. In other words, a teaching style that is particularly effective for accelerating perceptual-motor execution may not necessarily be the style that most strongly promotes peer communication, cooperation, feedback exchange, and interpersonal engagement. This finding is consistent with the broader conceptualization of teaching styles as distinct decision structures that influence not only technical learning but also the cognitive, affective, and social characteristics of the learning environment (2, 3, 5).

The superiority of the command teaching style in motor response speed can be interpreted in relation to the highly structured and externally regulated nature of this instructional approach. In the present intervention, the teacher directly controlled the timing of movement, the


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sequence of execution, the repetition pattern, and the provision of corrective feedback. This minimized uncertainty and reduced the number of decisions that players needed to make during practice. When a defensive error occurred, the teacher immediately identified the problem, provided a precise verbal or visual correction, and required the movement to be repeated under supervision. Such a structure may be particularly effective when the targeted outcome is rapid response execution because it allows players to concentrate their attentional resources on perceiving the stimulus and initiating the required movement rather than on simultaneously evaluating a partner, interpreting task criteria, or formulating feedback. The command style therefore appears to have created a practice environment in which motor-response pathways could be reinforced through repeated, consistent, and tightly controlled execution.

This interpretation is supported by literature emphasizing the value of direct and structured instruction in volleyball. Volleyball skills frequently require accurate positioning, precise timing, rapid movement, and efficient coordination of the upper and lower limbs. Altavilla emphasized that volleyball instruction involves a specific didactic problem because technical performance depends heavily on the teaching method selected and on the teacher's capacity to organize progression, correction, and repetition appropriately (7). Similarly, Hasan and Tuasikal noted that instructional models in volleyball must be matched carefully to the characteristics of the skill being taught, particularly when learners need to develop stable technical patterns (8). The results of the present study extend this logic to motor response speed, suggesting that when the learning objective is to reduce reaction and movement time, a command-oriented environment may offer an advantage by emphasizing externally paced repetition and immediate corrective control.

The current finding also aligns with studies indicating that drill-based and highly structured practice can improve volleyball performance. Sugito reported that systematic drill methods can enhance basic volleyball techniques when repetitions are organized around clearly defined technical objectives (9). Badaru and colleagues likewise demonstrated improvements in volleyball passing performance through focused and structured practice procedures (10). Although these studies examined technical outcomes rather than motor response speed directly, their results support the principle that repeated execution under controlled conditions can strengthen movement efficiency and technical consistency. In the present study, the command-style intervention may have accelerated motor responses through a similar mechanism, because repeated exposure to teacher-controlled cues and corrections likely reduced variability in preparation and movement initiation.

The effect of the command style on motor response speed may also be explained from a motor-learning perspective. Response speed in volleyball depends on both reaction time and movement time, and these components are influenced by attention, anticipatory organization, repeated stimulus-response coupling, and movement efficiency. Research on practice structure has shown that specific practice conditions can influence reaction time and inhibitory control (19). Schöllhorn and colleagues also emphasized that the model of motor learning embedded in instruction influences how movement adaptations are developed and stabilized (20). In the present study, the command style represented a relatively convergent form of practice in which the correct movement pattern was specified and reinforced repeatedly. This may have contributed to faster initiation of the defensive response because the players were exposed to a stable relationship between instructional cues and expected movement patterns.

At the same time, the superiority of the command style for motor response speed should not be interpreted as evidence that variable or learner-centered practice is generally less effective. Rather, the result should be understood in relation to the specific dependent variable and the duration of the intervention. Nonlinear pedagogy and variable-practice approaches argue that sport performance develops through adaptation to changing constraints rather than through the simple reproduction of a single ideal pattern (21, 22). Invernizzi and colleagues demonstrated that varied practice can support reaction time and executive-control development in young learners (19), while Rigon and colleagues highlighted the broader motor benefits associated with integrated and varied training experiences (23). The present results therefore suggest that, within an eight-week school volleyball intervention, a direct command structure may produce more immediate gains in measured response speed, whereas more exploratory or variable approaches


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may offer other adaptive advantages that were not directly assessed.

The second major finding was that the reciprocal teaching style produced significantly greater improvements in interactive behavior than the command style. This result was expected given the structural characteristics of the reciprocal method. In the reciprocal group, players worked in pairs and alternated between performer and observer roles. The observer was required to attend carefully to a teammate's performance, compare it with task-card criteria, identify relevant strengths or errors, and communicate feedback immediately. The performer, in turn, was expected to listen to the observer, respond to the feedback, and modify subsequent execution. This continuous cycle of observation, verbal exchange, correction, and role reversal naturally increased the frequency and quality of peer interaction. Consequently, the reciprocal style transformed interpersonal communication from an incidental feature of the lesson into a central mechanism of learning.

The finding is consistent with research showing that reciprocal teaching can enhance both learning processes and social participation. Pujianto and Insanistyo found that reciprocal teaching improved the instructional process in volleyball and increased student involvement in learning activities (13). Riyadi and colleagues also reported positive effects of reciprocal teaching on volleyball underhand passing outcomes, indicating that structured peer interaction can support sport-skill development while redistributing responsibility within the learning process (14). Marsuki's experimental comparison of command and reciprocal teaching styles in volleyball similarly demonstrated that the organization of instructional roles can meaningfully influence learning outcomes (15). The present study adds to these findings by showing that the reciprocal method may be particularly effective when interactive behavior itself is treated as a central dependent variable rather than merely as a background characteristic of instruction.

The improvement in interactive behavior may also be understood through the broader literature on teamwork and learner-centered pedagogy. D'Isanto and colleagues reported that heuristic learning methods in physical education can contribute to the development of teamwork skills by encouraging students to participate actively in problem solving and interaction rather than relying exclusively on teacher direction (16). Their related work also noted that heuristic and learner-centered approaches require careful organization and teacher guidance in order to remain educationally effective (17). This is highly relevant to the present intervention because the reciprocal style did not eliminate teacher involvement. Instead, the teacher redirected intervention toward the observer, guiding the student to identify performance criteria and provide appropriate feedback. This structure preserved the social and cognitive advantages of peer interaction while maintaining instructional accuracy.

The stronger effect of reciprocal teaching on interactive behavior is also consistent with research on motivation, responsibility, and social support in physical education. Rohmansyah and colleagues showed that teaching style can influence affective and cognitive motivation, suggesting that the distribution of responsibility within lessons affects how students engage with tasks and with one another (6). Xu and Hu emphasized the importance of social support and psychological safety in sustaining participation in volleyball environments (28). A reciprocal learning structure may strengthen these dimensions by normalizing constructive communication and making peer support part of the expected learning process. When students are encouraged to provide respectful corrective feedback and to receive it from teammates, the instructional environment can become more collaborative and less dependent on one-way teacher judgment.

The current findings are further supported by research on coaching and teaching beliefs. Backes and colleagues showed that beliefs about how sport should be taught influence the instructional practices selected by teachers and coaches (11). Barnes and Curtner-Smith also demonstrated that educational programs can shift coaches toward more learner-centered practices and change how they understand effective learning environments (12). These studies help explain why reciprocal teaching may have generated stronger interactive outcomes. When learning is organized around shared responsibility rather than exclusive teacher control, students become active contributors to the instructional process. The role of the learner changes from passive recipient to observer, communicator, evaluator, and partner, and these responsibilities are likely to stimulate the


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very behaviors measured as interactive behavior in the present study.

The reciprocal style may additionally promote cognitive processes that indirectly support social behavior. Kolovelonis and Syrmpas found that different teaching styles can influence inhibition, cognitive flexibility, and performance calibration (5). In reciprocal teaching, the observer must shift attention between task criteria and a teammate's movement, inhibit irrelevant responses, identify relevant errors, and formulate suitable feedback. The performer must also process peer information and adjust subsequent performance. These cognitive demands may contribute to more purposeful interaction because communication is directly linked to performance evaluation and action modification. In this sense, the reciprocal method integrates cognitive and social learning rather than treating them as separate instructional domains.

The present results are also consistent with the broader logic of the Spectrum of Teaching Styles. The spectrum proposes that different teaching styles are not simply better or worse than one another; instead, each style produces distinct learning conditions because decisions are allocated differently between teacher and learner (1-3). The current findings provide empirical support for this principle. The command style was more effective for motor response speed, an outcome that benefited from tight control, immediate correction, and repetition. The reciprocal style was more effective for interactive behavior, an outcome that depended on communication, observation, and shared responsibility. This differential pattern supports the argument that instructional effectiveness should be judged in relation to the intended learning objective rather than through a universal ranking of teaching styles.

The finding that both groups improved also deserves attention. Although the magnitude and direction of superiority differed between outcomes, neither method was ineffective. This suggests that both command and reciprocal teaching can contribute positively to school volleyball instruction when they are implemented systematically. Research comparing inclusion, guided discovery, reciprocal, and other teaching styles similarly indicates that different approaches can produce beneficial learning outcomes under appropriate conditions (14, 26). Mateos also reported that physical education students recognize the value of using different styles in their future professional practice, reflecting an understanding that instructional flexibility is important (4). The present findings therefore support a differentiated rather than exclusive use of teaching styles.

The results also correspond with emerging evidence favoring multiteaching approaches. Signorini and colleagues showed that combining teaching styles with active reflection can support learning in sport settings (24). Bartolo and colleagues also demonstrated that different teaching styles can influence the development of fundamental movement skills (27). Taken together, these studies suggest that teachers may obtain the strongest educational outcomes when they select or combine teaching styles according to the specific demands of the learning objective. In the case of school volleyball, direct command-based practice may be particularly useful during phases requiring rapid stabilization of defensive response patterns, while reciprocal learning may be more appropriate when the goal shifts toward peer communication, tactical reflection, and cooperative learning.

The present findings should also be interpreted within the technical characteristics of volleyball. Successful defense requires rapid processing of visual information, efficient footwork, accurate body positioning, and coordinated ball reception. Satardi and colleagues demonstrated the importance of training methods and eye-hand coordination in volleyball skill outcomes (25). Because the command-style group received immediate instructions concerning stance, foot placement, and arm positioning, the method may have strengthened the link between visual cues and technical action. Conversely, the reciprocal-style group engaged in more verbal and observational processing, which may have produced somewhat slower immediate response improvements but greater gains in interaction and shared task understanding.

Technology-mediated feedback research also supports the importance of how feedback is delivered. Rakha demonstrated that digital feedback integrated within reciprocal teaching can improve fundamental sport skills and learner attitudes (18). Although the present study used task cards and teacher-guided peer observation rather than digital tools, both approaches share the principle of decentralizing feedback and making learners active participants in the correction process. This suggests that reciprocal teaching

can be strengthened further through well-designed feedback systems, provided that the instructional purpose remains clear and peer interaction is preserved.

Overall, the findings support the view that pedagogical method is a substantive component of sport training rather than a neutral vehicle for delivering the same content. The command style produced stronger gains in motor response speed, most likely because it reduced decision complexity, increased repetition consistency, and provided immediate corrective control. The reciprocal style produced stronger gains in interactive behavior because it embedded communication, observation, cooperation, and shared responsibility within every practice sequence. These results are consistent with the central proposition of contemporary physical education pedagogy that learning outcomes are shaped by the interaction between task characteristics, instructional decision structures, and learner responsibilities (2, 3, 20). The practical implication is not that one method should replace the other, but that each should be selected deliberately according to the targeted outcome.

The present study has several limitations. First, the sample was relatively small and consisted only of 24 male school volleyball players from selected schools in Diyala Province, which limits the generalizability of the findings to female players, younger or older students, players from other regions, or athletes competing at different levels. Second, the intervention lasted eight weeks and included 16 instructional sessions, meaning that the results primarily reflect short-term instructional effects and do not establish whether the observed differences would be maintained over longer periods. Third, interactive behavior was evaluated within the instructional context of the study and may have been influenced by familiarity with teammates, observer expectations, or the specific task-card structure used in the reciprocal condition. Fourth, the study focused on only two teaching styles and two primary outcomes, while other potentially important variables such as tactical decision-making, motivation, self-efficacy, enjoyment, retention, transfer, and competitive performance were not assessed. Finally, although the main testing conditions were standardized, differences in day-to-day fatigue, school schedules, and individual readiness could not be controlled completely.

Future research should examine these teaching styles with larger and more diverse samples and should include female players, different age groups, and athletes from multiple educational or competitive settings. Longer intervention periods and delayed retention tests would help determine whether the advantages observed for motor response speed and interactive behavior persist over time. Future studies should also investigate hybrid instructional models in which command and reciprocal teaching are deliberately combined within the same training program, for example by using command instruction during the initial acquisition of rapid defensive movements and reciprocal teaching during later practice aimed at reflection, communication, and tactical understanding. Additional outcomes such as decision-making speed, tactical awareness, motivation, self-regulation, peer leadership, psychological safety, and actual match performance should also be included. It would also be valuable to compare traditional task cards with digital or video-assisted reciprocal feedback and to examine whether individual differences in skill level, cognitive flexibility, or coordination moderate responsiveness to different teaching styles.

From a practical perspective, physical education teachers and volleyball coaches should select instructional methods according to the specific learning outcome targeted in each phase of training. When the immediate objective is to accelerate defensive reactions, stabilize footwork, or correct technical errors rapidly, command-style instruction can be used to provide clear cues, synchronized repetition, and immediate correction. When the objective is to strengthen communication, cooperation, feedback skills, and responsibility among players, reciprocal teaching should be incorporated through structured pair work, task cards, role exchange, and guided peer feedback. A balanced program may alternate between the two styles rather than relying exclusively on one method. Teachers should also ensure that reciprocal observers are trained to recognize key performance criteria before being asked to evaluate teammates, while command-based sessions should avoid excessive dependence on teacher control once players have developed basic technical competence. In this way, school volleyball programs can use the strengths of both instructional approaches to support motor efficiency and positive team interaction simultaneously.


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## Authors' Contributions

All authors contributed substantially to the study and to manuscript development, and all approved the final version.

## Declaration

The authors declare that artificial intelligence tools were used only to assist with language editing, translation, and improvement of the manuscript's readability. All conceptualization, study design, data collection, data analysis, interpretation of findings, and final approval of the manuscript were performed by the authors. The authors take full responsibility for the accuracy, integrity, and originality of the content.

## Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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## Declaration of Interest

The authors report no conflict of interest.

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## Ethics Considerations

The study placed a high emphasis on ethical considerations. Informed consent obtained from all participants, ensuring they are fully aware of the nature of the study and their role in it. Confidentiality strictly maintained, with data anonymized to protect individual privacy. The study adhered to the ethical guidelines for research with human subjects as outlined in the Declaration of Helsinki.

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