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REVIEW

Video Modeling, Video Feedback, and Observational Learning in Basketball Free-Throw Performance: A Systematic Mini-Review

Amayra Tannoubi [1,2]*, Alexandru Ioan Băltean [3], Vlad Adrian Geantă [3]

[1] High Institute of Sport and Physical Education of Gafsa, University of Gafsa, Gafsa 2100, Tunisia

[2] Sports Performance Optimization Research Laboratory (LR09SEP01), National Center for Sports Medicine and Science (CNMSS), Tunis 1003, Tunisia

[3] Department of Physical Education and Sport, Faculty of Physical Education and Sport, Aurel Vlaicu University of Arad, Romania

* Correspondent author: amayra.tannoubi@issepgf.ugaf.tn

Abstract

Free-throw performance represents a critical component of scoring efficiency in basketball and has been widely investigated in motor learning research. In recent years, video-based instructional strategies such as video modeling, observational learning, and video feedback have gained increasing attention as tools for enhancing sport skill acquisition. The aim of this systematic mini-review was to synthesize empirical evidence regarding the effectiveness of video-based observational interventions on basketball free-throw performance. A systematic search was conducted in Scopus, Web of Science, and Google Scholar for peer-reviewed studies published between 2000 and 2025. Following duplicate removal and PRISMA 2020 screening procedures, eight studies met the predefined inclusion criteria and were included in the qualitative synthesis, highlighting the still limited evidence base in this specific domain. The methodological quality of the selected studies was evaluated using a five-criterion appraisal checklist adapted from the PEDro framework (Maher et al., 2003). Overall, the findings indicate that video-based observational interventions are generally associated with improvements in free-throw accuracy, movement consistency, and retention compared with traditional practice conditions. These outcomes are consistent with theoretical perspectives from observational learning theory, schema theory, the mirror neuron system, and the OPTIMAL theory of motor learning. Although the current body of evidence remains relatively limited, the results suggest that structured video modeling and observational learning strategies may represent effective pedagogical tools for improving free-throw performance in basketball training contexts.

Keywords: basketball, free-throw, video modeling, observational learning, motor learning, skill acquisition

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1. Introduction

Free-throw shooting is one of the most fundamental technical skills in basketball and often represents a decisive factor in game outcomes (Nakai et al., 2018). Because free-throws are executed without defensive interference, they provide players with uncontested scoring opportunities and are frequently considered an indicator of individual shooting proficiency (Cabarkapa et al., 2023; Han et al., 2026). Despite the relatively stable conditions under which the skill is performed, successful free-throw execution requires precise biomechanical coordination, consistent motor control, and effective perceptual–cognitive regulation (Amaro et al., 2025; Okazaki et al., 2015). As a result, even experienced basketball players may demonstrate variability in free-throw accuracy.

From a motor learning perspective, the free-throw is typically classified as a closed motor skill, performed in a stable and predictable environment where movement execution depends largely on the performer's ability to reproduce a consistent motor pattern (Schmidt, 1975). Closed skills are particularly suitable for investigating instructional strategies designed to improve movement consistency and technical precision. Traditional coaching approaches for developing shooting skills generally rely on verbal instruction, repetitive practice, and occasional demonstrations of proper technique (Smith et al., 2023). While these methods remain widely used, they may not fully exploit the visual and cognitive processes involved in observational learning and motor skill acquisition.

Advances in digital technology have increasingly enabled the integration of video-based instructional strategies in sport training (Mičiak et al., 2026). Techniques such as video modeling, observational learning, and video feedback allow athletes to repeatedly observe skilled movement patterns and analyze the technical components of performance (Tannoubi et al., 2023; Trabelsi et al., 2025). These visual learning approaches can facilitate the development of internal representations of movement, which may enhance motor planning and execution during practice (Tannoubi et al., 2026; Williams & Hodges, 2005). In sport settings, video-based learning tools have therefore become widely used to support skill acquisition and performance analysis.

The theoretical foundation for video-based instructional strategies draws upon several complementary frameworks in motor learning. Because free-throw performance requires the integration of cognitive, perceptual, motivational, and neuromuscular processes, no single theory fully explains the potential benefits of observational interventions. Accordingly, the following perspectives collectively provide a multidimensional explanation of how video-based learning may enhance shooting performance (Williams & Hodges, 2005). Observational learning theory proposes that individuals can acquire new behaviors by observing and imitating others (Bandura, 1986). According to this framework, observing a model performing a motor task enables learners to encode relevant visual information and construct cognitive representations of the movement. These representations subsequently guide motor execution when the learner attempts to reproduce the skill.

Complementing this framework, schema theory posits that motor learning involves the formation of generalized motor programs abstract internal rules that guide movement across varied contexts (Schmidt, 1975; Schmidt & Lee, 2019). Repeated exposure to skilled demonstrations through video modeling may enrich the learner's motor schema for the free-throw by providing multiple exemplars of successful movement coordination. This enriched schema may support the adaptability and consistency of shooting performance under varying practice conditions.

Neuroscientific research provides additional support for the effectiveness of observational learning. Studies on the mirror neuron system indicate that observing an action activates neural networks like those engaged during physical execution of the same action (Rizzolatti & Craighero, 2004). This motor resonance may promote neural simulation processes that facilitate the acquisition and refinement of movement patterns prior to physical practice. Consequently, observing skilled free-throw performances may prime motor pathways and subsequently enhance physical practice efficiency.

A further relevant perspective is the OPTIMAL theory of motor learning (Wulf & Lewthwaite, 2016), which emphasizes the joint contributions of an external focus of attention, enhanced expectancies of success, and learner autonomy in optimizing motor performance and learning. Video-based instructional strategies may align with these conditions by directing athletes' attention toward task-relevant performance cues, by highlighting successful movement executions that strengthen self-efficacy, and by offering athletes some control over when and how they review their performance.

In basketball, several experimental studies have examined the effects of video modeling and observational learning on shooting performance, particularly in relation to free-throw execution. Self-modeling and video feedback interventions have demonstrated improvements in shooting accuracy and motor learning outcomes (Aiken et al., 2012; Sheikhzadeh et al., 2025). More recent investigations have explored how observational modeling combined with attentional focus instructions or gaze training can influence both perceptual processes and shooting accuracy (Asadi et al., 2023; Nasri et al., 2025; Rezaei et al., 2023). Additional research has examined video-based instructional approaches within structured basketball training programs, reporting improvements in technical skill acquisition among novice players (Tannoubi et al., 2023). Experimental studies on free-throw learning have also highlighted the role of feedback and reinforcement mechanisms in supporting skill (Rafiee et al., 2019).

Despite the increasing interest in video-based instructional methods in basketball, evidence focusing specifically on free-throw performance remains limited and dispersed across studies using different intervention designs and participant populations. The free-throw represents a particularly meaningful unit of analysis because it is performed under standardized and repeatable conditions, minimizes defensive and contextual variability, and contributes directly to match outcomes. These characteristics make the free-throw especially suitable for evaluating instructional strategies aimed

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at improving technical consistency and motor learning (Choo et al., 2024; Han et al., 2022; Law & Hall, 2009).

Therefore, the purpose of this systematic mini-review was to synthesize empirical evidence on the effectiveness of video modeling, video feedback, and observational learning interventions for improving basketball free-throw performance. By reviewing experimental studies published between 2000 and 2025, this review aims to provide a clearer understanding of how video-based instructional strategies influence shooting accuracy and motor learning in basketball, and to identify practical implications for coaches and future research directions.

2. Methods

2.1 Literature Search

A systematic literature search was conducted to identify empirical studies examining the effects of video-based observational interventions on basketball shooting performance. The search was performed in three electronic databases: Scopus, Web of Science, and Google Scholar. Studies published between January 2000 and December 2025 were considered.

The search strategy combined keywords related to video-based instructional approaches and basketball shooting performance. Boolean operators were used to structure the search strings. The primary search string used in Scopus and Web of Science was: ("video modeling" OR "video modelling" OR "observational learning" OR "video feedback" OR "self-modeling" OR "self modelling") AND basketball AND ("free-throw" OR "free-throw" OR shooting). Minor adaptations of this syntax were applied to meet the indexing requirements of each database. For Google Scholar, the first 200 records sorted by relevance were screened for each search string. This cutoff was selected to balance search comprehensiveness with feasibility, as relevance-ranked results beyond this range typically show substantial declines in pertinence and increased duplication. Nevertheless, potentially eligible studies beyond this threshold may have been missed. The review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines.

2.2 Inclusion Criteria

Studies were included if they met the following criteria: (a) published in a peer-reviewed journal between 2000 and 2025, (b) written in English, (c) investigated basketball shooting performance, with a primary focus on free-throw outcomes or standardized shooting tasks closely related to the free-throw, (d) implemented a video modeling, video feedback, or observational learning intervention, and (e) reported quantitative performance outcomes such as accuracy, success rate, kinematic consistency, or retention. Experimental and quasi-experimental designs with pre- and post-intervention measures and, where possible, comparison groups were eligible. A small number of studies from closely related sport contexts were considered only when they provided directly transferable evidence regarding video-based motor-skill learning mechanisms. These were used

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primarily to illustrate underlying mechanisms rather than to define basketball-specific effect magnitudes.

2.3 Exclusion Criteria

Studies were excluded if they: (a) were review articles, theoretical papers, conference abstracts, or dissertations; (b) did not investigate basketball skills or did not report outcomes relevant to shooting performance; (c) provided purely biomechanical or descriptive analyses without an intervention or without quantitative performance outcomes; or (d) used video only for purposes unrelated to motor-skill instruction (e.g., match broadcasting without feedback).

2.4 Study Selection, PRISMA Flow Diagram, and Data Extraction

Study selection was conducted in two stages. First, titles and abstracts of all retrieved records were screened to determine potential eligibility according to the predefined inclusion and exclusion criteria. In the second stage, the full texts of potentially relevant articles were assessed for final inclusion.

The screening process was conducted independently by two reviewers. Disagreements were resolved through discussion until consensus was achieved. Inter-rater agreement for full-text eligibility decisions was high (Cohen's $\kappa = 0.85$), indicating substantial agreement.

The initial database search yielded 186 records. After removing 32 duplicate entries, 154 records remained for title and abstract screening. During this stage, 100 studies were excluded because they did not meet the inclusion criteria. The full texts of 54 articles were subsequently assessed for eligibility. Following full-text evaluation, 46 studies were excluded, primarily because they did not examine basketball shooting performance or did not implement a video-based observational intervention.

A total of eight studies met all inclusion criteria and were included in the qualitative synthesis. The study selection process is illustrated in the PRISMA flow diagram (Figure 1).

For each included study, the following information was extracted: (a) authors and publication year, (b) participant characteristics (age, skill level, and sample size), (c) type of observational or video-based intervention, (d) intervention duration and training structure, (e) comparison or control conditions, (f) main outcome variables related to shooting performance, and (g) statistical results and key findings.

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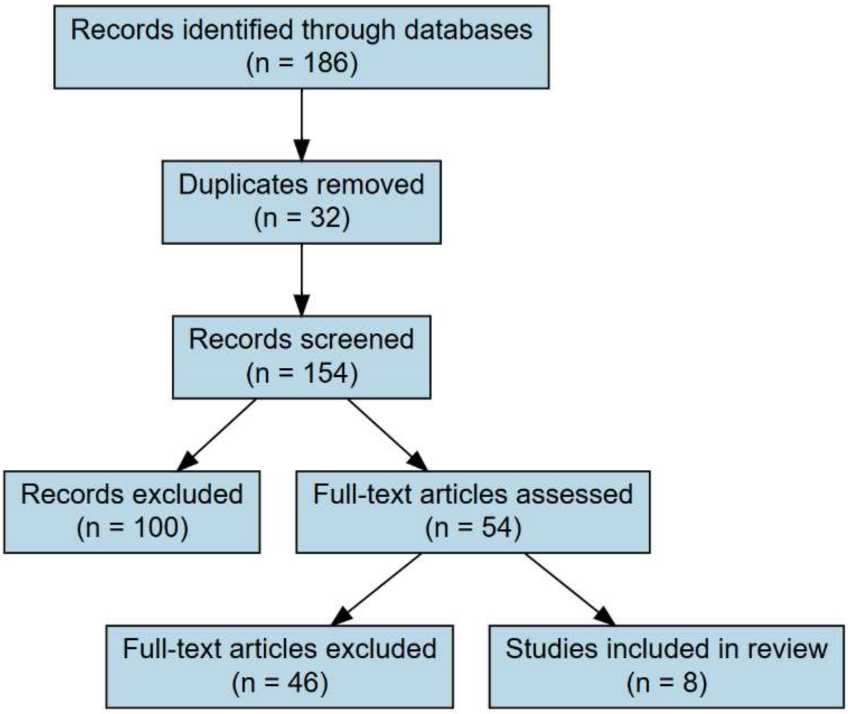

Figure 1. PRISMA 2020 flow diagram of the study selection process

2.5 Methodological Quality Appraisal

The methodological quality of the included studies was independently assessed by two reviewers using a five-criterion checklist adapted from the PEDro scale (Maher et al., 2003) and simplified for experimental sport-science interventions. The retained and adapted criteria focused on: (1) clear study design and objectives, (2) presence of a comparison or control condition, (3) standardized and reproducible intervention procedures, (4) valid and objective outcome measures, and (5) adequate statistical reporting of results.

Each criterion was rated as "Yes" (Y) when the criterion was clearly met, "No" (N) when the criterion was not met, and "Unclear" (U) when insufficient methodological detail was reported. Studies meeting four or five criteria were classified as high methodological quality, those meeting two or three criteria as moderate quality, and those meeting zero or one criterion as low quality. Discrepancies in quality ratings between reviewers were resolved through discussion and consensus. Inter-rater agreement for methodological appraisal was high (Cohen's $\kappa = 0.82$).

3. Results

3.1 Overview of Included Studies

Across the eight included studies, the overall direction of evidence was favorable to video-based observational interventions. Improvements were reported most for shooting accuracy, with several studies also describing benefits in confidence, technical consistency, retention, attentional control, or quiet-eye behavior. However, the magnitude and specific form of improvement varied across studies as a function of participant level, intervention format, and outcome definition.

Sample sizes ranged from 24 to 60 participants, including youth players, university students, and novice basketball players. Several forms of observational interventions were implemented. Self-modeling approaches were used in studies where athletes viewed edited videos of their own successful performances. Other studies employed expert video modeling, where participants observed demonstrations of correct shooting technique before or during practice sessions. More recent studies incorporated attentional focus cues and gaze-based modeling strategies, emphasizing perceptual components of free-throw performance.

Overall, the included studies consistently reported positive effects of observational and video-based interventions, including improvements in shooting accuracy, movement consistency, and motor skill retention. The characteristics of the eight included studies are summarized in Table 1.

Table 1. Characteristics of the studies included in the systematic mini-review examining the effects of video modeling and observational learning interventions on basketball free-throw performance.

Study	**N ; Skill Level**	**Intervention Type**	**Intervention Description**	**Comparison/Control**	**Key Outcome**
Ste-Marie et al. (2012)	N = 48 ; basketball players	Self-modeling	Participants viewed edited videos of own successful free-throw attempts	Practice without self-modeling	Improved shooting accuracy and self-confidence; moderate performance gains reported relative to practice-only condition (p > 0.05)
Aiken et al. (2012)	N = 28; novice women (SC n=14, YK n=14)	Self-controlled video feedback	Participants chose when to view own shooting form videos during acquisition; yoked group received matched feedback schedule	Yoked (YK) video feedback group	SC group: higher form scores at transfer, F(1,26) = 4.67, p = 0.040, η^2 = .153; no significant accuracy difference at transfer, F(1,26) =

					1.57, p = 0.221.
Sheikhzadeh et al. (2025)	N = 30; female high school students, age 16–18 (M_age Concurrent = 14.17 ± 1.08; Delayed = 14.82 ± 1.10; Control = 14.45 ± 1.06)	Concurrent video feedback (active video game) vs. delayed video feedback of own performance	Concurrent group: X-box 360 Kinect virtual free-throw simulation, 50 trials/session × 4 sessions, real-time avatar feedback, no real ball or basket. Delayed group: real free-throws (4.5 m from hoop), watched own performance video after each 10-trial block	No-feedback, no-acquisition control group	Significant post-test and retention improvements vs control (η^2=.23–.33); (p < 0.05).
Asadi et al. (2023)	N = 40; novice basketball players (M_age = 21.77 ± 1.40)	Observational modeling with attentional focus + gaze instruction	Observed model performing free-throws under external attentional-focus cueing and/or gaze instruction	Internal attentional-focus group ; verbal instruction control	External-focus and gaze-instructed groups outperformed internal-focus and control in accuracy and quiet-eye duration, p < 0.05.
Rezaei et al. (2023)	N = 45; female beginners (M_age = 21.62 ± 3.08; BMI = 23.48 ± 0.99 kg/m²)	Observational learning + attentional focus (internal vs. external)	Video modeling with internal vs. external focus strategy; 6 sessions × 2 × 10 attempts	Control (skilled model only, no attention strategy)	Immediate recall: F(2,42) = 4.96, p = 0.012. Delayed recall: between-group differences, p ≤ 0.05. Internal-focus

					> external-focus and control at delayed recall ($p \le 0.05$); external-focus vs. control: $p > 0.05$.
Rafiee et al. (2019)	N = 60; mixed skill	Observational demonstration + feedback (expert vs. beginner model)	Expert/beginner demonstrations with reinforcement feedback; role of imagery examined	Practice-only control	Significant accuracy improvement ($p < 0.05$).
Tannoubi et al. (2023) N = 24	N = 20; novice players (VMG: n=10, M_age = 12.5 ± 0.5; CG: n=10, M_age = 12 ± 0.7)	Video modeling	Video demonstrations before each practice session, 4-week program	Traditional instruction control	Efficiency index: VMG post > pre, $p = 0.013$, $d = 1.24$; Attack balls index VMG vs CG: $p = 0.001$, $d = 0.28$; Losing ball index VMG vs CG: $p < 0.001$, $d = -3.23$.
Nasri et al. (2025)	N = 48; novice students	Observational modeling (quiet-eye gaze)	Expert free-throw models emphasizing quiet-eye gaze behaviour	Standard observation control	Significantly increased quiet-eye duration and free-throw accuracy, $p < 0.05$.

3.2 Methodological Quality of Included Studies

The results of the methodological quality appraisal are presented in Table 2. Overall, the quality of included studies was moderate to high. All eight studies met Criterion 1 (clear research design) and Criterion 4 (valid and objective outcome measures). Six of the eight studies reported an explicit comparison or control condition (Criterion 2), while two studies used a single-group pre–post design without a concurrent comparison group. Standardized intervention protocols were clearly described in six studies (Criterion 3), with two studies providing insufficient methodological detail to confirm reproducibility. All studies reported between-group or pre–post statistical comparisons with appropriate descriptive statistics (Criterion 5). Based on this appraisal, six studies were classified as high quality and two as moderate quality. No studies were classified as low quality.

Table 2. Methodological quality appraisal of included studies (Y = Met; N = Not Met; U = Unclear).

Study	C1: Clear Design	C2: Comp. Group	C3: Stand. Protocol	C4: Valid Outcomes	C5: Stats Reported	Overall Quality
Ste-Marie et al. (2012)	Y	Y	Y	Y	Y	High (5/5)
Aiken et al. (2012)	Y	Y	Y	Y	Y	High (5/5)
Sheikhzadeh et al. (2025)	Y	Y	Y	Y	Y	High (5/5)
Asadi et al. (2023)	Y	Y	Y	Y	Y	High (5/5)
Rezaei et al. (2023)	Y	Y	Y	Y	Y	High (5/5)
Rafiee et al. (2019)	Y	U	U	Y	Y	Moderate (3/5)
Tannoubi et al. (2023)	Y	Y	Y	Y	Y	High (5/5)
Nasri et al. (2025)	Y	Y	U	Y	Y	Moderate (3/5)

Note. C1 = Clear research design; C2 = Comparison/control group allocation; C3 = Standardized and reproducible intervention protocol; C4 = Valid and objective outcome measures; C5 = Statistical comparisons and descriptive statistics reported. Quality ratings: High = 4–5 criteria met; Moderate = 2–3 criteria met; Low = 0–1 criteria met.

4. Discussion

The purpose of this systematic mini-review was to synthesize empirical evidence regarding the effectiveness of video modeling, video feedback, and observational learning interventions for improving basketball free-throw performance. Overall, the available evidence suggests that observational and video-based instructional strategies may facilitate improvements in shooting performance, particularly among novice and intermediate players.

However, the current body of research remains relatively limited, and the included studies differ considerably in terms of intervention structure, participant characteristics, and outcome measures. Consequently, the findings should be interpreted with caution, and further research using larger samples and standardized methodologies is required to strengthen the evidence base.

Importantly, the heterogeneity was not random. Studies involving novice or less experienced participants generally reported stronger gains than those involving mixed or more experienced samples, suggesting greater responsiveness among developing players. Likewise, interventions combining observation with feedback or attentional-focus cues appeared more effective than passive observation alone.

4.1 Effects of Video Modeling on Free-Throw Performance

A central finding of the present review is that video modeling interventions are frequently associated with improvements in free-throw performance, particularly in terms of shooting accuracy and technical execution. Several studies reported that observing demonstrations of correct shooting technique before or during practice sessions helped participants develop more consistent movement patterns and achieve higher shooting success rates (Sheikhzadeh et al., 2025). These findings suggest that visual observation of skilled performance may provide athletes with clearer references for the coordination and sequencing of movements required for accurate shooting.

Self-modeling interventions also demonstrated positive effects in several of the reviewed studies. In these approaches, athletes observed edited recordings of their own successful free-throw attempts, reinforcing effective movement patterns and strengthening confidence in their ability to perform the skill successfully (Aiken et al., 2012). Self-modeling may be particularly beneficial for novice or intermediate players because it highlights successful executions that the learner is already capable of performing, thereby increasing self-efficacy and facilitating more consistent motor performance.

4.2 Role of Attentional Focus and Perceptual Processes

Recent research included in this review highlights the importance of attentional focus and perceptual cognitive processes in observational learning. Studies examining observational modeling combined with attentional focus instructions demonstrated improvements in both shooting accuracy and visual attention control (Asadi et al., 2023; Rezaei et al., 2023). These findings suggest that directing athletes' attention toward task-relevant cues during model observation may enhance the effectiveness of video-based instructional interventions.

Gaze-based modeling interventions have further shown that observing expert performers' visual fixation patterns can improve perceptual control during free-throw execution. Research examining quiet-eye behavior demonstrated that observational modeling could increase visual fixation duration on the target and subsequently improve shooting accuracy (Nasri et al., 2025). These findings support the growing body of literature emphasizing the importance of perceptual processes in skilled sport performance.

4.3 Practical Implications for Basketball Coaching

The findings of this review have several practical implications for coaches and practitioners working in basketball training environments. First, incorporating video modeling sessions into regular practice routines may help players develop a clearer understanding of correct free-throw mechanics. Observing expert demonstrations can provide athletes with visual references for important technical elements such as body alignment, shooting rhythm, elbow positioning, and follow-through.

Second, the use of self-modeling and video feedback may allow athletes to analyze their own performances and identify areas for technical improvement. With the widespread availability of smartphones and video analysis applications, coaches can easily record athletes' shooting performances and provide immediate visual feedback during training sessions. Finally, integrating attentional focus cues and perceptual training strategies within video modeling interventions may further enhance their effectiveness. Encouraging athletes to focus on key task-relevant cues such as the target or ball trajectory may improve shooting consistency and attentional control during free-throw execution.

However, practical implementation may be influenced by contextual barriers such as limited training time, restricted access to recording devices or analysis software, and coaches' familiarity with evidence-based feedback methods. Simple smartphone-based approaches may help overcome many of these constraints.

4.4 Theoretical Interpretation of Findings

The findings of this review align with several complementary theoretical frameworks that explain how observational experiences facilitate motor learning.

Observational learning theory (Bandura, 1986) provides the most direct explanatory framework. Observing a skilled performer helps learners form cognitive representations of movement patterns that can subsequently guide physical practice (Williams & Hodges, 2005). Prior studies on self-modeling such as those by (Ste-Marie et al., 2012) have reported that participants who observed expert models or edited recordings of their own successful performances demonstrated improvements in shooting accuracy and technical consistency. These observations align with the broader pattern of positive findings reported across the studies included in this review.

Schema theory (Schmidt, 1975; Schmidt & Lee, 2019) further contextualizes these results by explaining how repeated video observation may strengthen generalized motor programs for the free-throw. Each exposure to a skilled model demonstration provides additional information about the relationship between movement parameters and successful outcomes, enriching the learner's internal movement template and supporting adaptability and retention.

The mirror neuron system (Rizzolatti & Craighero, 2004) offers a neuroscientific account of why observation alone produces motor learning benefits. Motor resonance during video observation may prime the neural pathways associated with executing the free-throw, so that subsequent physical practice builds upon already-activated motor representations. This mechanism may help explain when observational learning can be active when combined with limited physical practice.

Finally, the OPTIMAL theory of motor learning (Wulf & Lewthwaite, 2016) provides a motivational and attentional perspective. Video modeling interventions may naturally satisfy the three conditions the theory identifies as critical for learning: an external attention focus (directed toward the target or ball trajectory), enhanced expectations of success (through viewing successful performance models), and autonomy support (as in self-controlled feedback paradigms). The improvements in attentional control and shooting accuracy observed in studies using combined observational and attentional focus approaches (Asadi et al., 2023; Rezaei et al., 2023) are consistent with this theoretical account.

4.5 Limitations and Future Research Directions

Several limitations should be considered when interpreting the findings of this review. First, the number of studies meeting the inclusion criteria was relatively small, which limits the generalizability of the conclusions. Second, substantial heterogeneity was observed across studies in participant characteristics, intervention duration, and outcome measures, making direct comparisons difficult. Third, effect sizes were not consistently reported, preventing formal meta-analysis. Fourth, although study selection was conducted by two reviewers, data extraction was primarily performed by one reviewer, which may introduce a small risk of extraction bias. Fifth, the review was restricted to English-language publications and may therefore have excluded relevant evidence published in other languages.

5. Conclusion

This systematic mini-review examined the effects of video modeling, video feedback, and observational learning interventions on basketball free-throw performance. Across the eight included studies, observational and video-based instructional strategies appear to represent promising tools for improving basketball free-throw performance, particularly in novice and developing players.

These findings support theoretical perspectives from observational learning theory, schema theory, and the OPTIMAL theory of motor learning, suggesting that observing skilled performance can facilitate the development of effective motor representations and enhance subsequent physical practice.

From a practical perspective, the integration of video modeling and self-observation into basketball training may represent a valuable tool for coaches seeking to improve shooting performance. Nevertheless, further high-quality experimental research is needed to better understand the long-term effectiveness and optimal implementation of these instructional approaches.

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