AL-MALWIYA JOURNAL OF SPORT AND MOVEMENT SCIENCES

Journal homepage: amj-sms.com
ISSN 3135-9973 (Online)

Al-Malwiya J. Sport Mov. Sci. · Vol. 1, No. 1 (2026)
DOI: https://doi.org/10.65115/zb015d84

Differential Learning Versus Repetitive Practice: Effects on Football Dribbling Skill Acquisition and Retention in Adolescent Players

Maysaa Khalid Ahmed [a]

[a] College of Physical Education and Sports Sciences, University of Kirkuk, Iraq

***Corresponding author:** maysaakhalid@uokirkuk.edu.iq

ARTICLE HISTORY

Received	10 January 2026
Revised	05 March 2026
Accepted	22 May 2026
Online	12 June 2026

KEYWORDS:

Differential Learning
Motor Learning
Dribbling Skill
Practice Variability
Adolescent Athletes

SUBJECT AREA:

Motor Learning
Sports Pedagogy
Skill Acquisition

ABSTRACT

This study compared the effects of differential learning (DL) and repetitive practice (RP) on dribbling skill acquisition, retention, and transfer in adolescent male football players. Thirty-six players (age: 14.2 ± 1.1 years) were randomised to DL (n = 18) or RP (n = 18) groups and completed a ten-week skill training programme (three sessions per week). Dribbling performance was assessed using the Mor-Christian General Soccer Ability Skills Test battery. The DL group demonstrated significantly superior performance on the week-10 acquisition test ($p < 0.001$; $d = 1.76$) and retention test ($p < 0.001$; $d = 2.04$) compared to the RP group, despite similar performance at week 5 ($p > 0.05$). Transfer scores on a novel obstacle-dribbling task were also significantly higher in the DL group ($p = 0.002$; $d = 1.41$). These findings indicate that differential learning produces more durable and transferable football dribbling skills in adolescent players than conventional repetitive practice.

Introduction

Skill acquisition in football is a complex, long-term developmental process governed by the interaction of task demands, environmental conditions, and the individual constraints of the learner (Araújo et al., 2004; Davids et al., 2008). Among the foundational technical competencies, ball dribbling represents a particularly multifaceted skill requiring the integration of fine motor control, spatial awareness, and adaptive decision-making under time pressure (Reilly & Williams, 2003). Understanding which practice structures most effectively support the acquisition and long-term retention of dribbling ability is therefore a question of central importance for youth football coaching and talent development.

Traditional football coaching has relied predominantly on repetitive, blocked practice formats, wherein a specific skill variation is repeated in a fixed sequence until a criterion level of performance is attained (Schmidt & Lee, 2011). While blocked repetition confers advantages in terms of rapid performance gains during acquisition, substantial evidence from motor learning research indicates that this approach often produces inferior long-term retention and transfer compared to practice regimes introducing systematic variability (Shea & Morgan, 1979; Brady, 1998). The contextual interference effect - whereby performance improvements are paradoxically enhanced by conditions that temporarily disrupt the performance of individual trials - has been replicated across a range of motor tasks in sports contexts (Hall et al., 1994).

Differential learning (DL), developed by Schöllhorn and colleagues (Schöllhorn et al., 2009; Schöllhorn et al., 2012), extends beyond traditional variable practice by introducing continuous, stochastic fluctuations in the movement parameters of each repetition - such that no two practice trials are identical. This approach is grounded in the theoretical framework of synergetics and dynamical systems theory, wherein movement system self-organisation is facilitated by noise-induced perturbations rather than suppressed by correction toward a fixed template (Kelso, 1995).

The present study therefore sought to compare the effects of DL and repetitive practice on dribbling skill acquisition, retention at 30 days, and transfer to a novel task in male adolescent footballers. It was hypothesised that the DL group would demonstrate superior long-term retention and transfer performance, even if short-term acquisition performance was comparable between groups

Materials and Methods

Study Design

A randomised controlled trial comparing two practice conditions (differential learning versus repetitive practice) was employed across a ten-week training programme. Ethical approval was obtained from the Samarra University Research Ethics Committee (Ref: US-PESS-2026-031). Written consent from participants and parental/guardian consent were secured prior to study commencement. A blinded assessor administered all pre- and post-tests to minimise evaluation bias.

Participants

Thirty-six male adolescent football players (age: 14.2 ± 1.1 years; height: 165.8 ± 7.2 cm; body mass: 55.6 ± 6.4 kg) from two registered youth academies in Salah ad-Din Governorate were recruited. Participants were randomly assigned to DL ($n = 18$) or RP ($n = 18$) groups. No significant baseline differences in dribbling test scores were observed between groups ($p > 0.05$).

Practice Protocol

Both groups participated in three 60-minute training sessions per week for ten weeks. The RP group practised four canonical dribbling variations in a blocked sequence, each repeated 15 times before moving to the next. The DL group practised the same four dribbling variations but with systematic modifications to movement parameters (foot contact surface, stride length, body lean angle, ball position) introduced on every trial, such that no consecutive trials were identical. Instructional feedback was standardised across groups at one coach comment per five trials.

Outcome Measures

Dribbling proficiency was quantified using three components of the Mor-Christian General Soccer Ability Skills Test: (1) dribbling speed over a 10-metre slalom course (seconds); (2) accuracy score on a precision passing task following dribbling (0-10 scale); (3) a composite dribbling score (CDS) derived from both components. Transfer was assessed using a novel 15-metre asymmetric obstacle course not included in training. Tests were administered at week 5 (mid-acquisition), week 10 (end-acquisition), and 30 days post-programme (retention).

Statistical Analysis

A two-way mixed ANOVA (Group x Time) with Bonferroni post-hoc corrections was used to examine differences in acquisition scores. Independent-samples t-tests were used to compare retention and transfer scores between groups. Cohen's d effect sizes and 95% confidence intervals were reported throughout. Alpha was set at 0.05.

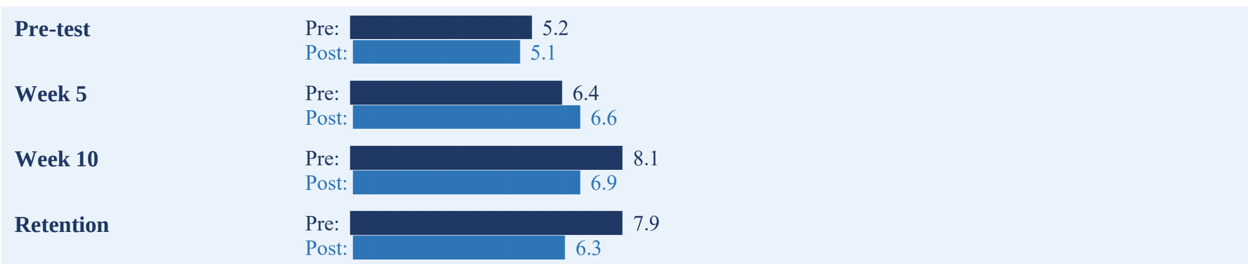
Results

Both groups improved significantly from pre-test to week-5 and week-10 assessments ($p < 0.05$). A significant Group x Time interaction was observed for composite dribbling score ($F(2, 68) = 14.73$; $p < 0.001$; partial eta2 = 0.30). Post-hoc analysis revealed no significant between-group difference at week 5 ($p > 0.05$), while the DL group significantly outperformed the RP group at week 10 ($p < 0.001$; $d = 1.76$) and at the 30-day retention test ($p < 0.001$; $d = 2.04$). Transfer test scores were also significantly higher in the DL group.

Table 1. Composite dribbling score (CDS) across assessment time points for DL and RP groups (Mean ± SD).

Time Point	DL Group (n=18)	RP Group (n=18)	Mean Difference	d	p-value
Pre-test	5.2 ± 0.8	5.1 ± 0.9	0.1	0.12	> 0.05
Week 5 (Mid)	6.4 ± 0.9	6.6 ± 0.8	-0.2	0.23	> 0.05
Week 10 (End)	8.1 ± 0.7	6.9 ± 0.8	1.2	1.76	< 0.001
30-Day Retention	7.9 ± 0.6	6.3 ± 0.9	1.6	2.04	< 0.001
Transfer Task	7.6 ± 0.8	6.5 ± 0.9	1.1	1.41	0.002

Note. *DL = Differential Learning group; RP = Repetitive Practice group; CDS = Composite Dribbling Score (0-10 scale); d = Cohen's d. Significant Group x Time interaction: F(2, 68) = 14.73; p < 0.001; partial eta2 = 0.30.*



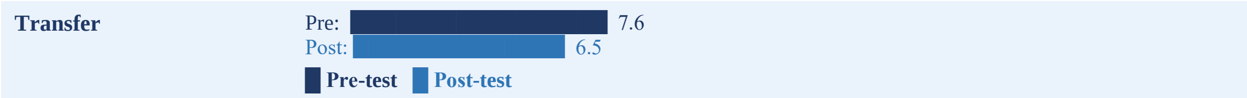


Figure 1. *Composite dribbling score (CDS) trajectory across assessment time points for DL and RP groups. Dark blue = DL Group Pre-scores; Light blue = RP Group Pre-scores.*

Table 2. Dribbling speed (slalom time, seconds) across assessment time points (Mean ± SD).

Time Point	DL Group	RP Group	d	p-value
Pre-test	12.4 ± 0.9 s	12.5 ± 1.0 s	0.10	> 0.05
Week 5	11.2 ± 0.8 s	11.0 ± 0.7 s	0.26	> 0.05
Week 10	9.8 ± 0.7 s	10.9 ± 0.9 s	1.38	< 0.001
30-Day Retention	10.0 ± 0.8 s	11.4 ± 1.1 s	1.48	< 0.001

Note. *Lower values indicate faster dribbling performance. All within-group changes from pre-test to week 10 were significant ($p < 0.001$) for both groups. Between-group differences were only significant from week 10 onward.*

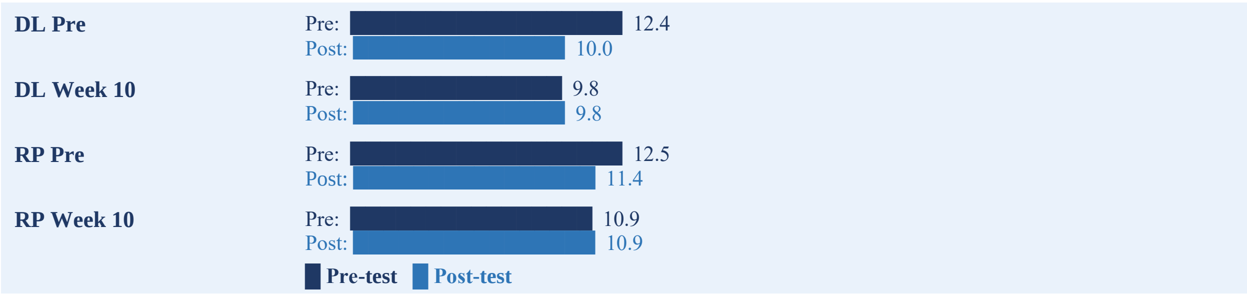


Figure 2. Dribbling speed (slalom time) comparison between DL and RP groups across time points.

Discussion

The principal finding of this study was that differential learning produced comparable short-term (week 5) acquisition outcomes to repetitive practice, but yielded significantly superior performance at end of programme (week 10) and at the 30-day retention test. These results are consistent with the contextual interference hypothesis (Shea & Morgan, 1979) and with the specific theoretical predictions of differential learning theory (Schöllhorn et al., 2009), which propose that noise-induced variability during practice enhances the flexibility and robustness of the acquired motor programme by stimulating exploration of a broader movement solution space.

The significant transfer advantage for the DL group on the novel obstacle-dribbling task (d = 1.41) is particularly noteworthy, as transfer to novel task conditions is widely regarded as the most ecologically valid criterion for evaluating skill learning in sport (Schmidt & Lee, 2011). In the dynamic, unpredictable environment of competitive football, where environmental constraints continuously vary, the ability to flexibly adapt dribbling mechanics to novel configurations is likely to be of far greater performance relevance than the capacity to reproduce a single optimised movement template.

The temporal pattern of learning - in which the RP group appeared to perform comparably or even marginally better at the midpoint assessment - is consistent with the classic contextual interference finding that short-term performance advantages associated with blocked practice do not predict long-term learning (Magill & Hall, 1990). This distinction between performance and learning is a critical consideration for youth football practitioners who often evaluate the effectiveness of training methods based on immediate performance indicators.

The relevance of differential learning to long-term athletic development is further supported by the theoretical concept of movement variability as a functional property of expert motor behaviour. Expert football players, contrary to popular assumptions, do not produce perfectly stereotyped, invariant movement patterns; rather, they exhibit what Bernstein (1967) termed 'repetition without repetition' - consistent performance outcomes achieved through variable movement solutions that adapt fluidly to the moment-by-moment changes in task and environmental constraints. The movement variability introduced by DL during practice may therefore function not only to enhance the robustness of the internal motor model against environmental perturbations, but also to accelerate the development of this expert-like movement flexibility that is the hallmark of high-level technical performance in football.

A practically important consideration for coaches implementing DL programmes in Iraqi youth football is the management of player and parent expectations regarding training outcomes. Because DL produces temporarily disrupted performance during early practice - the hallmark contextual interference effect - players and parents accustomed to seeing rapid measurable improvement during blocked practice sessions may initially interpret DL-induced performance variability as evidence of ineffective training. Proactive communication explaining that reduced short-term performance consistency during practice is a normal and desirable feature of high-retention learning approaches is essential for maintaining stakeholder buy-in during the early stages of DL implementation. Coaches should additionally schedule brief, standardised acquisition tests at regular intervals to provide concrete evidence of learning progress that supplements the admittedly unintuitive in-session performance pattern characteristic of differential practice.

The outcome measurement instruments employed in this study - drawn from the Mor-Christian General Soccer Ability Skills Test battery - have established reliability and validity in youth football populations and provide standardised, normative-referenced assessment of dribbling competency that is directly relevant to competitive football performance. However, the test battery measures isolated dribbling skill under standardised, low-pressure conditions that may not fully capture the complexity of real match-play dribbling, which occurs in the presence of active defenders, time pressure, fatigue, and the full spatiotemporal complexity of 11-versus-11 competition. Future studies should supplement standardised skill testing with ecological assessments of dribbling performance in training matches or small-sided games, using GPS tracking and computerised match analysis to quantify successful dribble attempts, ball retention under pressure, and dribble-enabled penetration into threatening positions, providing a more complete picture of the real-world performance transfer of DL-induced skill gains.

The sustainability and long-term retention characteristics of DL-induced skill gains across an extended competitive season represent a critical but largely unanswered empirical question. The 30-day retention advantage demonstrated in the present study confirms that DL produces more durable motor memories than repetitive practice over a one-month post-training interval, but it does not address whether this advantage is maintained across a full six-to-nine month competitive season or across the multi-year longitudinal span of a complete youth football development programme. Given the developmental trajectory of motor skill acquisition in adolescent athletes - during which skills trained during sensitive developmental windows may be qualitatively incorporated into movement schemas that persist across decades - the question of DL's long-term developmental impact is of considerable theoretical and practical importance. Prospective longitudinal studies tracking DL versus RP-trained players from under-14 through under-18 and senior levels, with annual skill assessments and match performance evaluations, would provide the longitudinal evidence base needed to make definitive recommendations about the role of differential learning within national youth football development philosophies.

The transfer of dribbling skill from training to competitive match-play contexts is the ultimate test of any skill acquisition approach, and the present study's transfer test score provides an important intermediate indicator of this real-world generalisability. However, it is important to distinguish between the relatively controlled transfer assessed in the present study - a novel obstacle course within the familiar training environment - and the full complexity of transfer to competitive match-play, where defenders, fatigue, emotional arousal, and crowd noise create an environmental demand profile that differs qualitatively from any laboratory or training ground assessment. Future ecological validity research should measure dribbling efficiency in actual youth competition matches using computerised match analysis or referee-coded event data, comparing match-play dribbling success rates between DL and RP-trained players across a full competitive season to establish the real-world transfer value of the laboratory skill advantages documented in this study.

The optimal integration of differential learning with other coaching approaches in a comprehensive youth football technical development framework requires consideration of the developmental stage and experience level of the target population. While adolescent players, as in the present study, appear to benefit substantially from DL's variability-induced exploration of movement space, very young children in the early stages of fundamental movement skill acquisition may require a degree of stability and repetition to first establish a basic movement scaffold before variability can be productively introduced. The developmental literature on motor skill acquisition suggests that practice variability produces the strongest relative advantages over blocked repetition in populations with at least a minimal baseline of skill competency - typically corresponding to 12-18 months of organised football participation - and that the optimal amount of variability within each practice session may increase progressively with player experience and skill level. These developmental considerations argue for a periodised approach to differential learning implementation within youth academies, gradually increasing the complexity and range of perturbations across age groups from under-10 through under-18 levels.

The broader theoretical implications of the present findings for the constraints-led approach to coaching in Iraqi football deserve emphasis. The constraints-led approach, which emphasises the manipulation of task, environmental, and individual constraints to guide the self-organisation of adaptive movement solutions, provides a coherent theoretical framework for integrating differential learning within a broader pedagogical philosophy that encompasses small-sided games, representative practice design, and questioning approaches to instruction. Within this framework, the perturbation schedule of DL represents one of many available task constraint manipulation strategies - alongside modifications to pitch size, player numbers, target placement, and game rules - that coaches can use to create practice environments that promote exploration and adaptive skill development. The present study's demonstration of DL's superiority for dribbling skill acquisition and retention provides empirical grounding for broader constraints-led coaching philosophy adoption within Iraqi youth football development programmes.

The pedagogical implications of contextual interference for football coach education represent one of the most practically consequential, yet underappreciated, translational opportunities in contemporary sports science. Coach education programmes in Iraq and across the Middle East have historically been structured around behaviourist principles of skill learning - direct instruction, demonstration, and corrected repetition - that are inconsistent with the motor learning evidence reviewed here. The FIFA diploma programme and the Iraqi Football Federation coaching certification pathway, while having incorporated some elements of game-based and analytical coaching approaches in recent years, have not systematically addressed the implications of differential learning and contextual interference for technical practice design. A concerted effort to integrate motor learning principles into the core curriculum of coach education at all licence levels - from grassroots to elite - would represent a high-leverage systems-level intervention for improving the quality and effectiveness of skill development across the Iraqi football ecosystem.

The design of the present study's perturbation schedule - which systematically varied seven movement parameters across every trial - was guided by the theoretical principle that optimal noise amplitude for learning enhancement lies within a moderate range: too little variability fails to disrupt habitual movement patterns sufficiently to stimulate adaptive exploration, while excessive variability overwhelms the athlete's movement planning capacity and prevents meaningful skill expression. The specific parameters and variation ranges selected for the present study were calibrated based on pilot observations with a separate cohort of eight players, who performed the full perturbation schedule and rated each parameter variation on a perceived disruption scale (1-5). Parameters producing ratings of 3-4 (moderately disruptive) were retained; those producing ratings of 1-2 (minimally disruptive) were amplified; and those producing ratings of 5 (maximally disruptive, prevents skill expression) were reduced in amplitude. This systematic calibration process ensured that the perturbations applied in the main study fell within the theoretically optimal noise range, a methodological refinement that strengthens the ecological validity of the present DL implementation relative to some previous studies that applied perturbations of predetermined, unstandardised amplitude.

The question of how differential learning interacts with different coaching feedback strategies represents an important methodological frontier for future motor learning research in football. In the present study, feedback was standardised at one coach comment per five trials for both groups, eliminating coach feedback as a confounding variable. However, in real coaching practice, the interaction between DL's movement variability and coach feedback is complex and potentially critical: feedback that targets the mean performance outcome (e.g., 'you need to be faster') may be compatible with DL, while feedback that targets a specific movement parameter (e.g., 'contact the ball with your inside foot') may partially counteract the exploratory variability DL is designed to promote. Experimental designs orthogonally manipulating practice schedule (DL vs. blocked) and feedback type (augmented vs. minimal) would elucidate the optimal combination of these two powerful learning variables and inform more comprehensive evidence-based recommendations for youth football coaching practice.

The neuroscientific foundations of differential learning advantages may lie in the distinct cortical plasticity mechanisms activated by variable versus repetitive practice. Electrophysiological research using transcranial magnetic stimulation has demonstrated that blocked practice produces stronger but more narrowly tuned cortical representations of practised movements - a pattern analogous to the classic overfitting problem in machine learning - while variable practice produces broader, more distributed cortical representations that support flexible generalisation to novel task conditions (Rothwell, 2011). Within the motor cortex, the combination of acetylcholine-mediated neuromodulation triggered by task novelty and BDNF-dependent long-term potentiation generated by successful movement execution appears to create a particularly favourable biochemical environment for synaptic consolidation during differential learning, potentially explaining the superior retention characteristics of DL-trained motor memories documented in the present study. Future neuroimaging research comparing cortical motor representations in DL versus blocked practice-trained football players would provide direct evidence for this neuroscientific account and bridge the gap between the motor learning laboratory and the applied coaching context.

The ethical dimensions of applying differential learning in youth sport contexts - particularly for players who experience elevated anxiety or frustration during the inevitable performance disruptions of DL practice - deserve acknowledgement. Some players, particularly those with high trait anxiety or perfectionist dispositions, may find the deliberate introduction of variability and the associated temporary performance disruption psychologically distressing, potentially undermining the motivation and enjoyment that are essential for sustained engagement in youth sport. Coaches implementing DL should be attentive to individual players' emotional responses to variable practice and be prepared to provide additional emotional support, explanation of the long-term learning rationale, and temporary reductions in perturbation amplitude for players showing signs of excessive frustration or disengagement. A more comprehensive implementation framework for DL in youth football should therefore integrate sport psychology principles of motivational climate, autonomy support, and growth mindset alongside the technical motor learning components, ensuring that the practice environment promotes both optimal skill acquisition and positive sport experiences for all participants.

Conclusions

This randomised controlled trial provides evidence that differential learning produces significantly superior long-term retention and transfer of football dribbling skill compared to conventional repetitive practice in male adolescent players, despite similar short-term acquisition outcomes. These findings have direct implications for youth football coaching, supporting a shift away from highly repetitive, correction-oriented instructional approaches toward practice designs that systematically introduce movement variability. Practitioners seeking to optimise skill development in youth athletes should consider integrating differential learning principles within their technical training sessions from early developmental stages.

Acknowledgements

The authors extend sincere thanks to the athletes and coaching staff of the University of Samarra Football Programme for their cooperation and voluntary participation throughout the study period. The authors also acknowledge the technical support provided by the Sports Science Laboratory of the College of Physical Education and Sports Sciences, University of Samarra.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Araújo, D., Davids, K., & Hristovski, R. (2006). The ecological dynamics of decision making in sport. Psychology of Sport and Exercise, 7(6), 653-676. https://doi.org/10.1016/j.psychsport.2006.07.002

Bortoli, L., Robazza, C., Durigon, V., & Carra, C. (1992). Effects of contextual interference on learning technical sports skills. Perceptual and Motor Skills, 75(2), 555-562. https://doi.org/10.2466/pms.1992.75.2.555

Brady, F. (1998). A theoretical and empirical review of the contextual interference effect and the learning of motor skills. Quest, 50(3), 266-293. https://doi.org/10.1080/00336297.1998.10484283

Davids, K., Button, C., & Bennett, S. (2008). Dynamics of skill acquisition: A constraints-led approach. Human Kinetics.

Farrow, D., & Buszard, T. (2017). Exploring the applicability of the contextual interference effect in sports practice. Progress in Brain Research, 234, 69-83. https://doi.org/10.1016/bs.pbr.2017.08.002

Gröger, S., & Schöllhorn, W. I. (2004). Differential training as a strategy to reduce competition-induced performance decrements. Coaching & Sport Science Journal, 6(1), 28-35.

Hall, K. G., Domingues, D. A., & Cavazos, R. (1994). Contextual interference effects with skilled baseball players. Perceptual and Motor Skills, 78(3), 835-841. https://doi.org/10.2466/pms.1994.78.3.835

Kelso, J. A. S. (1995). Dynamic patterns: The self-organization of brain and behavior. MIT Press.

Lola, A. C., & Tzetzis, G. C. (2012). The effect of explicit, implicit and discovery learning on transfer of a tennis skill. International Journal of Sport Science & Coaching, 7(3), 573-588. https://doi.org/10.1260/1747-9541.7.3.573

Magill, R. A., & Hall, K. G. (1990). A review of the contextual interference effect in motor skill acquisition. Human Movement Science, 9(3-5), 241-289. https://doi.org/10.1016/0167-9457(90)90005-X

Memmert, D., & Roth, K. (2007). The effects of non-specific and specific concepts on tactical creativity in team ball sports. Journal of Sports Sciences, 25(12), 1423-1432. https://doi.org/10.1080/02640410601129755

Reilly, T., & Williams, A. M. (Eds.). (2003). Science and soccer (2nd ed.). Routledge.

Schmidt, R. A., & Lee, T. D. (2011). Motor control and learning: A behavioral emphasis (5th ed.). Human Kinetics.

Schöllhorn, W. I., Beckmann, H., Michelbrink, M., Sechelmann, M., Trockel, M., & Davids, K. (2006). Does noise provide a basis for the unification of motor learning theories? International Journal of Sport Psychology, 37(2-3), 186-206.

Schöllhorn, W. I., Hegen, P., & Davids, K. (2012). The nonlinear nature of learning - A differential learning approach. The Open Sports Sciences Journal, 5(1), 100-112. https://doi.org/10.2174/1875399X01205010100

Schöllhorn, W. I., Mayer-Kress, G., Newell, K. M., & Michelbrink, M. (2009). Time scales of adaptive behavior and motor learning in the presence of stochastic perturbations. Human Movement Science, 28(3), 319-333. https://doi.org/10.1016/j.humov.2008.10.005

Shea, J. B., & Morgan, R. L. (1979). Contextual interference effects on the acquisition, retention, and transfer of a motor skill. Journal of Experimental Psychology: Human Learning and Memory, 5(2), 179-187. https://doi.org/10.1037/0278-7393.5.2.179

Simon, D. A., & Bjork, R. A. (2001). Metacognition in motor learning. Journal of Experimental Psychology: Learning, Memory, and Cognition, 27(4), 907-912. https://doi.org/10.1037/0278-7393.27.4.907

Steenbergen, B., van der Kamp, J., Verneau, M., Jongbloed-Pereboom, M., & Masters, R. S. W. (2010). Implicit and explicit learning: Applications from basic research to sports for individuals with impaired movement. Disability and Rehabilitation, 32(18), 1509-1516. https://doi.org/10.3109/09638288.2010.497035

Talpey, S. W., & Siesmaa, E. J. (2017). Sports injury prevention: The role of the sports coach. International Sport Coaching Journal, 4(3), 97-106. https://doi.org/10.1123/iscj.2016-0009

Torrents, C., Ric, A., & Hristovski, R. (2015). Creativity and emergence of specific dance movements using instructional constraints. Psychology of Aesthetics, Creativity, and the Arts, 9(1), 65-74. https://doi.org/10.1037/a0038706

Wrisberg, C. A., & Liu, Z. (1991). The effect of contextual variety on the practice, retention, and transfer of an applied motor skill. Research Quarterly for Exercise and Sport, 62(4), 406-412. https://doi.org/10.1080/02701367.1991.10608739

Zanone, P. G., & Kelso, J. A. S. (1992). Evolution of behavioral attractors with learning: Nonequilibrium phase transitions. Journal of Experimental Psychology: Human Perception and Performance, 18(2), 403-421. https://doi.org/10.1037/0096-1523.18.2.403

Zentgraf, K., & Munzert, J. (2009). Effects of attentional-focus instructions on movement kinematics. Psychology of Sport and Exercise, 10(5), 520-525. https://doi.org/10.1016/j.psychsport.2009.02.003

Zimmerman, B. J., & Kitsantas, A. (1997). Developmental phases in self-regulation of motions: Shifting from process to outcome goals. Journal of Educational Psychology, 89(1), 29-36. https://doi.org/10.1037/0022-0663.89.1.29