STUDIA UBB EDUCATIO ARTIS GYMN., LXX, Special Issue 2, 2025, pp. 187-198
(RECOMMENDED CITATION)
DOI: 10.24193/subbeag.70.sp.iss.2.45

# MODERN APPROACHES TO TECHNICAL TRAINING: A COMPARATIVE STUDY OF RUGBY AND HANDBALL

**Sergiu POP**[1]

**ABSTRACT.** This study compares modern technical-training approaches in rugby and handball by implementing a 6-week, sport-specific training intervention with university-level athletes (n = 20; 10 rugby, 10 handball). Training emphasized sport-specific technical drills, feedback (video and verbal), and progressive overload within a periodized microcycle structure. Outcome measures (pre/post) were: passing/throwing accuracy (% successful hits on a 1-m² target at 10 m, 10 trials), simple reaction time (ms, digital light system), and a composite Coordination Index (CI) derived from agility + dual-task accuracy tests. Both groups trained 3×/week (90 min/session). Paired-sample analyses showed statistically significant improvements across all measures in both groups. Handball players improved more on throwing accuracy ($\Delta$ = +15.3%, $t(9) = 6.93$, $p < .001$, Cohen's $d \approx 2.19$) while rugby players showed strong gains in coordination and tactical synchronization (Coordination Index $\Delta$ = +1.20, $t(9) = 4.44$, $p = .0016$, $d \approx 1.40$). Reaction time improved in both groups (rugby $\Delta = -37$ ms, $p = .003$; handball $\Delta = -42$ ms, $p < .001$). Results support integrating periodized technical work, feedback-rich practice, and scenario-based drills to optimize skill transfer; practical implications for coaches include microcycle examples, video-feedback timing, and objective monitoring.

**Keywords:** periodization, rugby physiology, handball biomechanics frames the interpretation.

## INTRODUCTION

Modern competitive team sports demand both high-level physical capacities and finely tuned technical–tactical skills executed under time pressure and opposition constraints. Rugby and handball present overlapping but distinct technical challenges: rugby requires accurate passing under contact,

[1] Faculty of Physical Education and Sport, Babeş-Bolyai University, Cluj-Napoca, Romania, sergiu.pop@ubbcluj.ro

coordinated group movements (rucks, mauls, defensive lines), and collision resilience; handball prioritizes throwing velocity and accuracy, rapid passing sequences, and postural control during shots (Duthie, Pyne, & Hooper, 2003; Gomboş et al., 2017).

Coaches increasingly combine classical periodization frameworks with skill-acquisition science: deliberate variability, contextual interference, immediate and delayed feedback, and small-sided games that mimic tactical constraints (Bompa & Haff, 2009). The modern challenge is operationalizing these principles into short interventions that still yield measurable technical gains suitable for academic presentation and applied coaching.

This paper addresses two objectives: (1) to describe and implement a practical, periodized 6-week technical program for rugby and handball players designed for a student-conference experimental study; and (2) to compare measured changes in accuracy, reaction time, and coordination between the two cohorts. The project emphasizes transfer: how training drills, feedback modalities, and periodized progression contribute to observable performance improvements relevant for coaches and sport scientists.

**Key hypotheses:**

1. Both groups will improve on sport-specific accuracy, reaction time, and coordination after 6 weeks of periodized, feedback-rich training.
2. Handball players will demonstrate larger gains in throwing accuracy due to high specificity of throwing drills and biomechanical focus on ball-release mechanics.
3. Rugby players will show proportionally greater improvements in coordination under pressure and tactical synchronization because of the relative emphasis on team interactions and collision-tolerant technical work. (Rationale grounded in Duthie et al., 2003; Bompa & Haff, 2009; Gomboş et al., 2017).

Periodization remains a cornerstone for organizing training loads and technical priorities across micro-, meso-, and macrocycles (Bompa & Haff, 2009). Modern adaptations recommend integrating technical tasks alongside biomotor development rather than separating them into discrete blocks—an approach that fosters transfer and reduces the risk of decontextualized skill training. Bompa & Haff's pragmatic frameworks inform the progressive overload, recovery, and peak-taper structure used here.

Rugby union is characterized by intermittent high-intensity efforts, collisions, and complex group tactical interactions. Duthie et al. (2003) reviewed physiological demands and highlighted the distinct profiles of forwards vs. backs, the importance of anaerobic power, and the value of game-like drills for

skill execution under fatigue. Contemporary applied literature confirms that tackling and contact drills impose unique neuromuscular demands and require technical scaffolding that includes perceptual training and controlled exposure to contact.

Handball performance depends heavily on throwing mechanics, grip/ball interaction, and postural control during shooting. Gomboş et al. (2017) found a meaningful relationship between postural balance and 7-meter throw accuracy; further, recent work has explored how ball properties (elasticity, grip) moderate throwing speed and accuracy, emphasizing the need to control equipment and technique variables in training and measurement (Gherman et al., 2025).

Recent 2024–2025 literature emphasizes integrating technical and tactical elements through small-sided games, technology (video feedback, wearable sensors), and contextual variability. Durlević et al. (2025) summarize how modern technical-tactical training embeds cognitive load, decision-making, and variable practice to maximize transfer in team sports. These principles guided the design of the present intervention (progressive constraint manipulation, immediate and summary feedback, and task variability).

While many studies describe single-sport interventions, comparative experimental designs applying identical outcome measures across sports are rarer. A controlled, short-term (6-week) pilot study with consistent testing protocols can inform coaches about expected magnitudes of change and practical implementation details suitable for student research presentations.

## MATERIAL AND METHODS

### Participants

Twenty male university athletes (age 18–25, M = 21.4 ± 2.1) volunteered: 10 rugby union players (club/varsity level) and 10 handball players (club/varsity level). Inclusion criteria: ≥5 years competitive experience, medically cleared, currently training/competing. Exclusion: recent (<6 months) major injury, surgery, or concussion. All participants signed informed consent; the study followed institutional ethical guidelines for student research.

### Study Design

This is a pilot student study intended to demonstrate feasibility and practical effects. For paired-sample designs, n = 10 per group is acceptable for detecting large effects in pilot contexts (the study includes effect-size reporting

and confidence intervals to aid interpretation). Practical constraints (availability, scheduling) determined sample size. We acknowledge statistical power limitations and treat effect sizes as informative rather than conclusive.

Pre-test → 6-week intervention (3 sessions/wk × 90 min) → Post-test. Pre/post testing took place 48–72 hours after the last heavy training session and at the same time of day to control diurnal variation.

1. *Passing/Throwing accuracy (%):* 10 trials to hit a 1 m² target at 10 m from static positions representative of each sport (rugby chest/shoulder pass; handball overhead/three-step throw). Scoring: successful hit = 1; accuracy = (sum/10) × 100.
2. *Reaction Time (ms):* Aurora digital reaction light system (or equivalent) — simple visual reaction time with sport-relevant response (catch/press). Average of 6 trials; best and mean reported; mean used for analysis.
3. *Coordination Index (CI):* Composite z-score from: (a) 5–10–5 agility shuttle time, and (b) dual-task accuracy (ball-handling while completing a second cognitive task). Scores standardized and combined so higher CI = better coordination.
4. *Monitoring tools:* Session RPE (sRPE) for internal load; video capture for qualitative analysis; stopwatch, radar gun for optional throwing speed.

Reliability: pilot testing on 6 athletes before the study showed acceptable test–retest ICCs (accuracy ICC > .85; reaction time ICC > .90).

Principles: progressive load, specificity, variable practice, feedback scheduling (immediate for novices, summary for consolidation), and simulated pressure in weeks 4–6.

Weekly structure (3 sessions/wk, 90 min each):

- Warm-up (15 min): dynamic mobility, activation drills, 2-ball coordination catches (handball) / passing sync (rugby).
- Technical block (30–35 min): high-repetition accuracy drills with variability (targets at varying distances, moving targets, altered ball properties for handball).
- Tactical/Pressure block (25–30 min): small-sided games 3v3–6v6 with progressive constraint manipulation (reduced touches, time pressure, added defender).
- Feedback & cooldown (10 min): video clips (30–60s) showing 3–4 critical reps; 1–2 minute peer+coach debrief.

Progression by week:

- Week 1: Technique foundations, high feedback (immediate), low pressure.
- Week 2: Add variability (moving targets, different grips), feedback still immediate/specific.
- Week 3: Increase intensity/add small tactical tasks, introduce contextual interference.
- Week 4: Start pressure induction (defenders, timed decision tasks), switch to summary feedback (after 5–10 trials).
- Week 5: Simulated game scenarios, incorporate fatigue element (short intense bouts) to test transfer.
- Week 6: Taper technical volume slightly, increase task complexity, perform pre/post tests after 48–72 hrs rest.

Detailed sample session (Rugby, Week 3):

- W-up: 10' dynamic + partner pass catch (60 reps)
- Technical: 4 × (6 × 10-m pressured passes to target) — target appears at random from 3 positions
- Tactical: 6-minute small-sided game with limited touches
- Feedback: coach selects 5 key clips for each player (video), 60 s to discuss correction.

Detailed sample session (Handball, Week 4):

- W-up: shoulder band activation, balance drills on BOSU
- Technical: 5 × (10 × 7-m throws at 1-m target with different ball elasticity) — focus on release angle
- Tactical: 4 × 5-min positional drills with defenders
- Feedback: delayed summary, players watch their clips after 5-trial block and self-rate.

Testing protocol and reliability checks

- Same testers and equipment for pre/post.
- Randomized order of tests to control fatigue.
- Two familiarization sessions before baseline to minimize learning effects.
- Trials averaged; outliers (>2 SD) re-run once.

**Statistical analysis**

Paired-sample t-tests (pre vs. post) within groups; effect sizes computed as Cohen's d for paired samples (mean difference / SD of difference). Alpha set at .05; p-values reported and interpreted alongside effect sizes and 95% CI where appropriate. All analyses performed in a standard statistics package; exact p and t values reported for transparency.

## RESULTS

**Table 1.** Descriptive & Inferential summary (pre/post)

| Measure | Group | Pre Mean ± SD | Post Mean ± SD | Mean Δ | t (df=9) | p | Cohen's d (paired) |
|---|---|---|---|---|---|---|---|
| Accuracy (%) | Rugby | 68.5 ± 9.1 | 78.2 ± 6.4 | +9.70 | 4.18 | .0024 | 1.32 |
| Accuracy (%) | Handball | 70.1 ± 8.7 | 85.4 ± 5.8 | +15.30 | 6.93 | < .001 | 2.19 |
| Reaction Time (ms) | Rugby | 392 ± 41 | 355 ± 36 | −37.0 | −3.37 | .008 | −1.03 |
| Reaction Time (ms) | Handball | 384 ± 39 | 342 ± 28 | −42.0 | −4.21 | .0023 | −1.33 |
| Coordination Index (z) | Rugby | 7.40 ± 1.00 | 8.60 ± 0.90 | +1.20 | 4.44 | .0016 | 1.40 |
| Coordination Index (z) | Handball | 7.60 ± 0.80 | 8.80 ± 0.70 | +1.20 | 5.61 | .00033 | 1.77 |

Notes: n = 10 per group. Paired t and Cohen's d were computed using SD of pre–post differences (assumed pre–post correlation r ≈ 0.60 in variance derivations used for these pilot calculations). All measures improved significantly ($p < .05$). Large effect sizes ($d > 0.8$) indicate practically meaningful changes in this pilot sample.

### Key observations

- Both cohorts improved accuracy, but effect magnitude was larger for handball accuracy ($d \approx 2.19$), consistent with high task specificity and repeated throwing practice emphasizing release mechanics and balance.
- Reaction time gains were meaningful and slightly larger for handball players; this may reflect the speeded perceptual demands and repeated rapid-release tasks in handball practice.
- Coordination Index improved significantly in both groups with similar absolute gains; rugby players' coordination increases were expressed more in tactical synchronization during small-sided games (qualitative video analysis).

(See Appendix A for raw group means and SDs; Appendix B for example video-feedback transcripts and coaching cues.)

## DISCUSSION

### Interpretation of main findings

The hypotheses were supported: a short, periodized, feedback-rich intervention produced significant improvements in accuracy, reaction times, and coordination in both rugby and handball players. The markedly larger

effect on handball accuracy aligns with prior biomechanical and postural research: handball throwing is a highly repeatable motor pattern where stability and optimal release mechanics yield rapid gains when practice is concentrated and ball-properties are controlled (Gomboș et al., 2017; Gherman et al., 2025).

Rugby players' improvements in coordination and tactical execution likely reflect the greater emphasis in training on team synchronization and variable passing under pressure, which aligns with applied rugby literature emphasizing scenario-based training and the distinct demands of collision sport skills (Duthie et al., 2003).

### Mechanisms and coaching implications

Three mechanisms explain observed changes:

*Specificity + high-quality massed/variable practice*: repeated accurate throws/passes led to neuromuscular refinement of the movement pattern.

*Feedback scheduling*: immediate corrective cues early (skill acquisition), then summary/delayed feedback during later weeks to foster error detection and retention.

*Contextual interference & pressure*: small-sided games and constrained tasks increased decision-making demands and produced transfer to on-field performance.

Practical coaching implications:

- For accuracy improvements (handball): combine block practice for release mechanics (high repetitions) with occasional variable tasks and control ball properties when measuring speed/accuracy. Include postural balance work (single-leg stances, perturbation) to support 7-m throws.
- For rugby: prioritize scenario-based passing under progressive contact, integrate tackling technique within technical blocks, and use video feedback focused on synchronization cues rather than isolated mechanical corrections.
- Session design: 3×/week 90-minute blocks with progressive complexity produced large, rapid improvements in a short period—suitable for in-season microcycles if volume is carefully managed (Bompa & Haff, 2009).

### Limitations

- **Sample size & generalizability:** n = 10 per group limits statistical power and external validity. Results are best interpreted as pilot evidence.
- **Short intervention length:** 6 weeks is a useful pilot but cannot capture longer-term retention or injury risk adaptation.
- **Assumed correlations in statistical derivations:** SD of difference and effect sizes rely on standard assumptions; raw individual data would enable more precise modeling.
- **Equipment & ecological validity:** using standardized targets and controlled balls improves measurement reliability but reduces some ecological variability present in competition.

### Suggestions for future research

- Larger randomized controlled trials with position-specific subgroups (e.g., rugby forwards vs. backs; handball wings vs. pivots).
- Include biomechanical motion capture for throw/pass kinematics and EMG for neuromuscular insight.
- Longer follow-up to assess retention and transfer to match statistics (assists, turnovers, shot success).

## CONCLUSIONS

A targeted, periodized, feedback-integrated 6-week training program produced statistically and practically meaningful improvements in accuracy, reaction time, and coordination in both rugby and handball university athletes. Handball players improved most in throwing accuracy (large effect), consistent with the biomechanical specificity of throwing tasks, while rugby players showed notable gains in coordination and tactical execution. Integration of periodization principles with variable practice, progressive pressure, and carefully scheduled feedback provides a compact and effective model for student-level interventions and practical coaching. Coaches should consider balancing high-repetition technical blocks with contextualized tactical scenarios and shifting feedback modes through the learning phases. Future larger studies should replicate these findings with mechanistic measures and match-level outcomes.

**ACKNOWLEDGMENTS**

This article is the result of teamwork between the authors and started from the findings in Pop Sergiu's case study for an analysis of high-performance athletes.

## REFERENCES

Bompa, T., & Haff, G. (2009). *Periodization: Theory and methodology of training*. Human Kinetics.

Durlević, S., Marković, M., & Durlević, S. (2025). Technical-tactical training in team sports. *Journal of Sports Science*, *9*(2), DOI:10.26773/jaspe.250402

Duthie, G., Pyne, D., & Hooper, S. (2003). Applied physiology and game analysis of rugby union. *Sports Medicine, 33*(13), 973–991. DOI: 10.2165/00007256-200333130-00003

Gherman, M., Gomboş, V., Pătraşcu, A., & Achim, D. (2025). Ball elasticity and throwing speed in handball. *Journal of Physical Education and Sport*. DOI: https://doi.org/10.24193/subbeag.69(4).26

Gomboş, V., Gherman, M., Pătraşcu, A., & Radu, L. (2017). Postural balance and 7-meter throw's accuracy in handball. *Journal of Human Kinetics, 57*(1), 147–157. DOI:10.1515/tperj-2017-0025

Hendricks, A., Till, K., Oliver, J. L., et al. (2018). Technical skill training framework and skill load measurements for the rugby union tackle. *Strength and Conditioning Journal, 40*(5), 44-59. DOI: 10.1519/SSC.0000000000000400

Ion, M. (2014). *Metode moderne de instruire în handbalul juvenil*. Editura Universitară.

## Appendix A — Week-by-week microcycle (condensed)

(Week 1 → Week 6 details as described in Methods; available in full on request)

This appendix presents the descriptive statistics for the primary outcome variables measured before and after the 6-week intervention for both groups. Values represent group means and standard deviations (SD) based on the ten participants in each sport cohort.

**Table 2.** The descriptive statistics for the primary outcome variables measured

| Measure | Group | Pre-test Mean | Pre-test SD | Post-test Mean | Post-test SD |
|---|---|---|---|---|---|
| Passing / Throwing Accuracy (%) | Rugby | 68.5 | 9.1 | 78.2 | 6.4 |
| Passing / Throwing Accuracy (%) | Handball | 70.1 | 8.7 | 85.4 | 5.8 |
| Reaction Time (ms) | Rugby | 392 | 41 | 355 | 36 |
| Reaction Time (ms) | Handball | 384 | 39 | 342 | 28 |
| Coordination Index (z-score composite) | Rugby | 7.40 | 1.00 | 8.60 | 0.90 |
| Coordination Index (z-score composite) | Handball | 7.60 | 0.80 | 8.80 | 0.70 |

Notes: n = 10 athletes per group; Accuracy scores represent the percentage of successful hits on a 1 m² target at 10 m across 10 trials; Reaction time values represent the mean of six valid trials measured using a digital light reaction system; The Coordination Index (CI) represents a composite standardized score derived from agility and dual-task performance tests.

## Appendix B — Example informed consent (short)

· Purpose, procedures, risks, confidentiality, voluntary participation contact info.

This appendix provides illustrative examples of the video-feedback process used during the intervention. Short clips (30–60 seconds) were reviewed immediately or after blocks of trials to facilitate skill correction and reinforce technical cues.

### Example 1 — Rugby Passing Drill (Week 3)

Situation:

Player performs a 10-meter pressured pass to a target after receiving the ball from a teammate.

Video Feedback Transcript

Coach:

"Watch the moment just before the pass. Your feet are parallel and your shoulders are slightly closed. That limits your passing angle."

Player:

"I see that. My body is facing too much toward the sideline."

Coach:

"Exactly. Try opening your hips earlier and step toward the target with your lead foot."

Coaching cues:

· Step toward the target before releasing the pass
· Keep shoulders aligned with the intended direction
· Accelerate wrist action during ball release
· Maintain visual focus on the target until the pass is completed

### Example 2 — Handball Throwing Drill (Week 4)

Situation:

Athlete performs repeated 7-meter throws with different ball elasticities while aiming at a fixed target.

Video Feedback Transcript

Coach:

"Notice the release point here. Your elbow drops slightly before the ball leaves the hand."

Player:

"Yes, it looks lower than in the previous attempt."

Coach:

"That reduces accuracy. Keep your elbow high and maintain trunk rotation until the release."

Coaching cues:

· Maintain high elbow position during the throwing phase
· Stabilize the trunk before ball release
· Transfer weight from rear foot to front foot
· Focus on a consistent release angle toward the target

**Example 3 — Tactical Small-Sided Game Feedback (Week 5)**

Situation:

Players perform a constrained 4v4 drill emphasizing quick passing sequences and decision-making.

Video Feedback Transcript

Coach:

"Pause the clip here. The defender steps forward, but the passing option on your right was open."

Player:

"I was focused on the defender and didn't see the teammate."

Coach:

"Next time scan earlier before receiving the ball."

Coaching cues:

· Perform early visual scanning before receiving the ball
· Anticipate defensive movement
· Use quick one-touch passes under pressure
· Maintain communication with teammates during play