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Tactical decision-making following filanesia-based ecological dynamics in youth football through a multisite cluster-randomized trial

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Abstract

Background: National playing philosophies can guide youth development, but whether a culturally situated framework offers lasting benefits beyond generic game-based practice remains unclear.
Aims: This study compared Filanesia-based ecological dynamics (Filanesia-ED), generic ecological dynamics (Generic-ED), and conventional coaching for retained tactical decision-making, multidomain tactical adaptation, and pressure-stratified decision accuracy.
Methods: A multisite three-arm cluster-randomized trial involved 144 players nested in 12 youth football teams in Lampung and North Sumatra, Indonesia. Teams completed 16 sessions over eight weeks, with assessment at pretest, posttest, and four-week retention. Analyses included longitudinal tactical outcomes, 9,806 match-decision events, 192 fidelity observations, and 1,152 small-sided-game GPS records. Player outcomes were analyzed longitudinally, and decision events were examined using generalized estimating equations. Findings were interpreted in the context of 12 randomized teams.
Result: The longitudinal model showed a condition-by-time interaction, Wald $\chi^2(4) = 363.83$, $p < .001$. At posttest, the adjusted Filanesia-ED advantage was 12.59 points versus conventional coaching (95% CI [8.51, 16.67]) and 6.32 points versus Generic-ED (95% CI [2.25, 10.39]); corresponding retention differences were 11.33 and 6.75 points. In the event-level analysis, Filanesia-ED had higher odds of a correct decision under high opponent pressure than conventional coaching, OR = 1.74, 95% CI [1.33, 2.27], $p < .001$.
Conclusion: Filanesia-ED was associated with higher posttest and retained tactical decision-making scores than either comparison. Multidomain findings are exploratory; replication across more teams and longer competitive follow-up is warranted.

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INTRODUCTION

Football decisions depend on continuous perception–action coupling under changing game constraints. Decision quality has been linked to executive control, inhibition, brain-network organization, and skilled heuristics or deception (Heisler et al., 2023; Li et al., 2024; Matsutake et al., 2024; Ramanayaka et al., 2024; Ramsey et al., 2025). As domain-general control and football knowledge develop at different rates, representative tasks should offer appropriate choices rather than treat tactical intelligence as fixed (Heisler et al., 2023; Matsutake et al., 2024; Li et al., 2024).

Valid tactical assessment requires representative information: 360-degree diagnostics depend on informational fidelity (Höner et al., 2023); a football tactical instrument has psychometric support (Barquero-Ruiz et al., 2022; Barquero-Ruiz et al., 2024); field tests must match target behavior (Clemente, Praça, et al., 2022), and scanning relates to success under pressure (Hintermann et al., 2024). Ecological dynamics describes affordances as opportunities for action relative to players and

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evolving game configurations. Manipulating constraints can elicit adaptive solutions rather than prescribed movements (O'Sullivan et al., 2023; Petiot et al., 2026; Wood et al., 2023).

A national framework may orient representative practice if adapted to local conditions (O'Sullivan et al., 2025). Here, Filanesia supplied collective intentions for progression, support, organization, and transitions; ecological dynamics guided their translation into constraints without requiring fixed movement patterns. Filanesia (*Filosofi Sepak Bola Indonesia*), published by the Indonesian Football Association in 2017, specifies age-referenced development and interconnected attacking, transition, and defending phases (Danurwindo et al., 2017; PSSI, n.d.). It offers tactical intentions for age-appropriate practice rather than a mandatory formation. Filanesia research has examined coach understanding and curriculum adoption (Efendi et al., 2023; Surapana & Syafi'i, 2021; Weda & Kurniawan, 2022), but evidence of retained decision gains under representative play is limited.

Comparing Filanesia-ED with both Generic-ED and conventional coaching helps distinguish framework-specific organization from the general effect of game-based practice. Small-sided games preserve game relations while varying numbers, area, and rules; these constraints affect tactics, participation, and load (Clemente, et al., 2022; Coito et al., 2022; Ferreira-Ruiz et al., 2022; Ueda et al., 2023). Playing area and numerical format alter movement exposure, interactions, and decisions (Castillo-Rodríguez et al., 2023; Clemente et al., 2023; de Dios-Álvarez et al., 2025; Praça et al., 2022; Santos et al., 2024), while formations and full-versus-small game formats modify collective behavior (González-Rodenas et al., 2025; Silvino et al., 2024). Coach instructions and game design affect spatial adaptation and passing cooperation (Abreu et al., 2024; O'Brien-Smith et al., 2025). Longitudinal evidence remains heterogeneous (Morais et al., 2026); counterattack tasks can manipulate time and numbers without prescribing solutions (Rochael & Praça, 2024).

Constraints also affect tactical exploration and creativity (de Joode et al., 2023; Santos et al., 2023; Ueda et al., 2025). Tactical-principle interventions report decision gains (Gaviria Alzate et al., 2024; Machado et al., 2024), whereas dual tasks may impair performance (Moreira et al., 2025; Rezende & Praça, 2025). Tactical learning should be interpreted alongside load because area, pressure, age, and format affect physical demands (Castillo-Rodríguez et al., 2023; Chen et al., 2023; Santos et al., 2024), with concurrent effects on cognition and movement (Coutinho et al., 2023; Skala & Zemková, 2023). Reviews describe short-term designs and inconsistent reporting (Clemente, et al., 2022; Coito et al., 2022; Morais et al., 2026). Despite benefits of game-based interventions (Machado et al., 2024; Pop et al., 2022; Sørensen et al., 2024), added Filanesia value beyond generic ecological practice and delayed retention remain unclear. We compared Filanesia-ED, Generic-ED, and conventional coaching at baseline, posttest, and four-week retention. The primary hypothesis predicted a larger retained TDM-composite gain with Filanesia-ED. Tactical domains, pressure-specific accuracy, fidelity, and tactical–physical associations were complementary or exploratory.

METHOD

Research Design

This multisite, three-arm cluster-randomized study assigned intact youth football teams in Lampung and North Sumatra to Filanesia-ED, Generic-ED, or conventional coaching. Sixteen sessions were delivered over eight weeks; assessments occurred at baseline (Week 0), posttest (Week 8), and retention (Week 12). Player-level outcomes, match decisions, fidelity, and GPS data were collected. Reporting was informed by CONSORT 2025 (Hopewell et al., 2025) and its cluster-trial extension (Campbell et al., 2012).

Study Setting and Participants

Participants were 144 youth players from 12 registered academy teams (four teams and 48 players per condition): 110 males and 34 females, aged 13.5–17.5 years. Recruitment occurred in Lampung and North Sumatra from June to October 2025. Eligibility required league registration, at least two years of organized training, and physical clearance; recent severe musculoskeletal injury or concurrent specialized tactical intervention excluded participation. An independent statistician generated computer-based, region-stratified block randomization, with each condition represented in both provinces. Twelve teams (144 players) were allocated: four teams (48 players) per arm; all completed the Week 0, 8, and 12 assessments, supported by make-up testing within 48 h. Block size,

concealment, and the numbers screened before randomization were not documented. Figure 1 presents the intervention workflow rather than a CONSORT recruitment-flow diagram.

Filanesia defines ages 14–17 as the game phase and ages 10–13 as skill development. Thirteen eligible players were younger than 14 years and remained with their randomized teams; age and maturity offset were adjustment covariates. Excluding them left Filanesia-ED versus conventional estimates similar (posttest 12.57; retention 11.52 points). With 12 randomized teams, the independent allocation units were teams rather than the 144 players or 9,806 decisions; cluster-level uncertainty remains relevant. No prospective cluster-based sample-size calculation was reported.

Ethics

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the Department of Sports Coaching Education, Universitas Negeri Medan (official approval letter dated 28 August 2024, No. 671-A/UN33-08/PKO/2024). Parents or guardians provided written consent and players provided written assent. Academy and provincial PSSI permissions were obtained; participation was voluntary, and records were pseudonymized.

Table 1. Participant Characteristics by Intervention Condition

Condition	Teams	Players	Age, years	Training age, years	Female, n (%)	Attendance, %	Baseline TDM
Conventional	4	48	15.39 (0.90)	6.32 (1.56)	14 (29.2)	87.0 (5.7)	59.03 (11.07)
Generic-ED	4	48	15.40 (0.90)	6.00 (1.57)	8 (16.7)	87.6 (6.5)	57.91 (9.57)
Filanesia-ED	4	48	15.34 (0.93)	5.99 (1.48)	12 (25.0)	90.5 (5.0)	60.42 (8.03)

Note. Values are means (SDs) unless otherwise stated. TDM = tactical decision-making composite (0–100).

Baseline TDM scores were comparable across conditions (Table 1). Attendance, measured after allocation, was examined only in sensitivity analysis.

Intervention Conditions

All teams received 16 sessions (mean 88.1 min; SD 6.0; range 75–104). Both ecological arms used representative, constraint-led games; Filanesia-ED additionally organized problems, questioning, and progression around national tactical intentions. This contrast evaluated the added framework rather than small-sided-game exposure alone (Table 2). Games progressed from 3v3 to 7v7 plus goalkeepers, with pitches ranging from 30 × 40 to 50 × 70 m. Format-specific pitch–roster pairings were unavailable, so no single relative-area range is asserted. Program-level work–rest ratios were 1:1 or 2:1, usually with 4–6-min bouts and 2–3-min active recovery. Players' additional club activity was tracked through diaries and session RPE to assess external training exposure.

Table 2. Operational Contrast Among Coaching Conditions

Design feature	Conventional	Generic-ED	Filanesia-ED
Primary organizing logic	Coach-led technical and tactical rehearsal	Ecological task design	Filanesia principles enacted through ecological task design
Representative game information	Variable and not systematically prioritized	Explicitly prioritized	Explicitly prioritized and linked to Filanesia phases and principles
Constraint manipulation	Limited or coach-prescribed	Systematic manipulation of task and environment	Systematic manipulation to invite Filanesia-consistent solutions
Task variability	Lower or externally prescribed	Variable practice with multiple functional solutions	Variable practice bounded by Filanesia tactical intentions

Design feature	Conventional	Generic-ED	Filanesia-ED
Coach communication	Predominantly corrective instruction	Guided questioning and attentional direction	Guided questioning using Filanesia language and game intentions
Player agency	Lower decision autonomy	Exploration and self-regulation encouraged	Exploration and self-regulation within a nationally situated playing framework

Generic-ED controlled for representative game-based practice; Filanesia-ED added explicit national tactical intentions (Table 2).

Measures

The primary outcome was a 0–100 tactical decision-making (TDM) composite assessed at all three time points. Its nine domains were accuracy, reversed latency, scanning, support positioning, creativity, affordance perception, adaptability, collective synchronization, and technical execution. Components were standardized before aggregation; internal consistency was α = .826 (pretest), .874 (posttest), .878 (retention), and .882 (overall). These coefficients describe score coherence rather than unidimensionality. Standardization reference, weights, and transformation constants were not available for independent reconstruction; domain outcomes are therefore presented separately.

Two elevated Sony FDR-AX43 cameras (4K, 60 frames/s) recorded play for LongoMatch PRO coding. Three blinded analysts, each AFC B-qualified with more than five years' youth experience, completed 10 h of calibration and achieved at least 85% agreement on benchmark clips. Indicator ICCs ranged from .89 to .94 (two-way mixed-effects, absolute agreement); the single- versus average-measure specification and recoded-clip count were not reported. External experts developed a general-football decision rubric to reduce Filanesia-specific criterion bias. The 9,806 coded decisions were recorded during standardized match assessments, with eight match exposures reported per player; decision events were nested within players and teams. Recorded variables were phase, pressure, decision type and correctness, action success, latency, pre-action scans, and perceived exertion. Pressure was low (nearest defender >3 m), moderate (1–3 m), or high (<1 m or physical contact), with κ = .88. This distance-based measure omits defender orientation, closing speed, and option availability. Match duration, field dimensions, opponent assignment, substitutions, and goalkeeper arrangements were not documented.

The 192 fidelity observations covered 12 teams × 16 sessions and rated representative design, constraint manipulation, task variability, guided questioning, player-centeredness, and condition-specific Filanesia alignment. Across six dimensions, α = .950; this is score coherence, not observer agreement. Observers were unblinded, and fidelity inter-rater estimates were not documented. Separately, 1,152 small-sided-game GPS observations were obtained using Catapult Vector S7 devices (10 Hz; 100 Hz accelerometry) for distance, high-speed and sprint running, accelerations, decelerations, and player load. Sampling dates and observation-level exposure were not fully specified. Tactical efficiency was a synchronized, derived measure rather than a GPS output; its formula and speed thresholds were not available, so this analysis remains exploratory.

Procedure

Figure 1 summarizes baseline testing, allocation of four teams per condition, 16 monitored sessions, Week 8 assessments, and Week 12 retention. The match-event and GPS samples characterize distinct observations and do not represent repeated measurements of the same decision events over time.

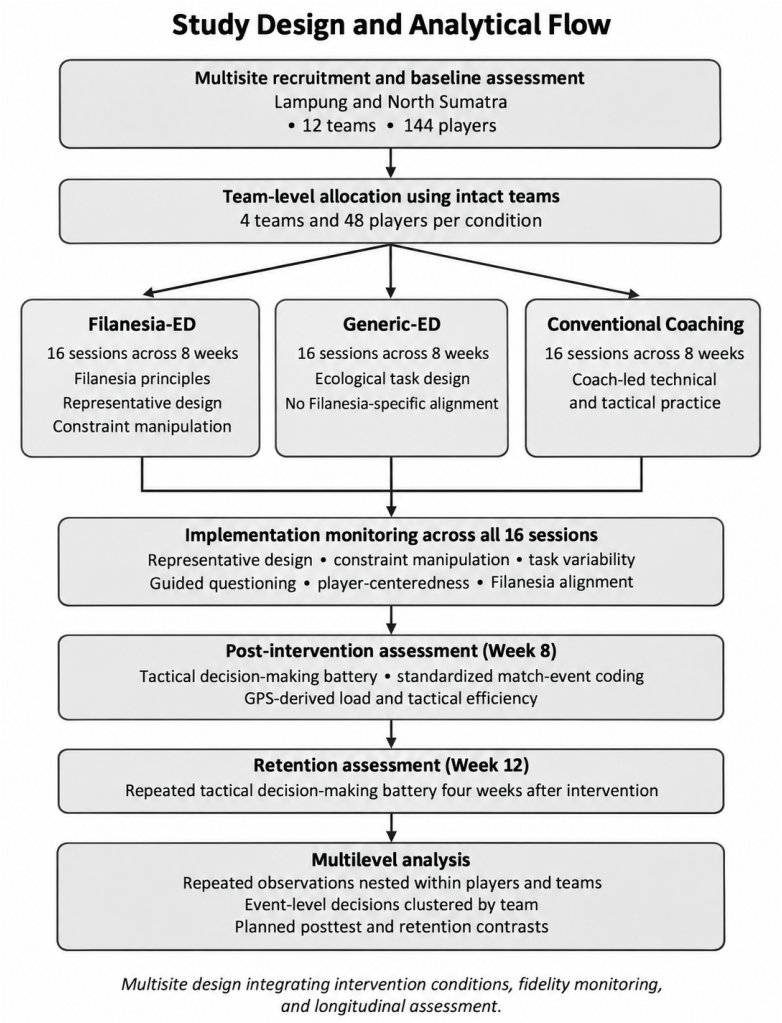


Figure 1. Study Design and Analytical Workflow for the Multisite Cluster-Randomized Study in Lampung and North Sumatra

The diagram identifies the Filanesia-ED pathway and the main assessment stages. The sequence links intervention delivery to posttest outcomes and four-week retention.

Statistical Analysis

Repeated TDM outcomes were analyzed using maximum-likelihood linear mixed effects with condition, time, their interaction, and a player random intercept; covariates included age, training age, maturity offset, sex, prior skill, and province. Post-allocation attendance was not adjusted for in the primary model. Baseline tactical intelligence ($r = .81$ with baseline TDM) was examined in sensitivity analyses, which did not materially alter estimates. Planned contrasts used $t(11)$ as the reference distribution for 12 teams. The model summary did not identify a separate team variance component, a team-level covariance estimator, or a primary-outcome ICC; therefore, reported interval precision is interpreted cautiously. Details of maturity offset and prior-skill measures were unavailable.

Nine domain changes were expressed in baseline-SD units relative to conventional coaching and treated as exploratory. Benjamini–Hochberg adjustment was specified, but the complete raw and adjusted p-value table was unavailable; no domain-specific significance claims are made. Team-clustered binomial GEE modeled event correctness by condition, pressure, their interaction, phase, decision type, match, and baseline tactical intelligence ($t(11)$ reference); the working-correlation form and any small-cluster covariance correction were not documented. Exploratory Gaussian GEE modeled tactical efficiency with adjustments for load, high-speed and sprint running, position, and physical capacity. Tests were two-sided ($\alpha = .05$), reporting 95% CIs. Analyses used SPSS 30.0; figures were created using Python 3.13.5 and Matplotlib 3.10.8.

RESULTS AND DISCUSSION

Results

Primary Tactical Decision-Making Outcome

Figure 2 shows observed TDM trajectories (mean [SD]). Conventional coaching: 59.03 (11.07), 60.68 (11.41), and 60.76 (11.47) at pretest, posttest, and retention; Generic-ED: 57.91 (9.57), 66.29 (9.87), and 64.68 (8.42); Filanesia-ED: 60.42 (8.03), 74.70 (8.39), and 73.51 (9.06).

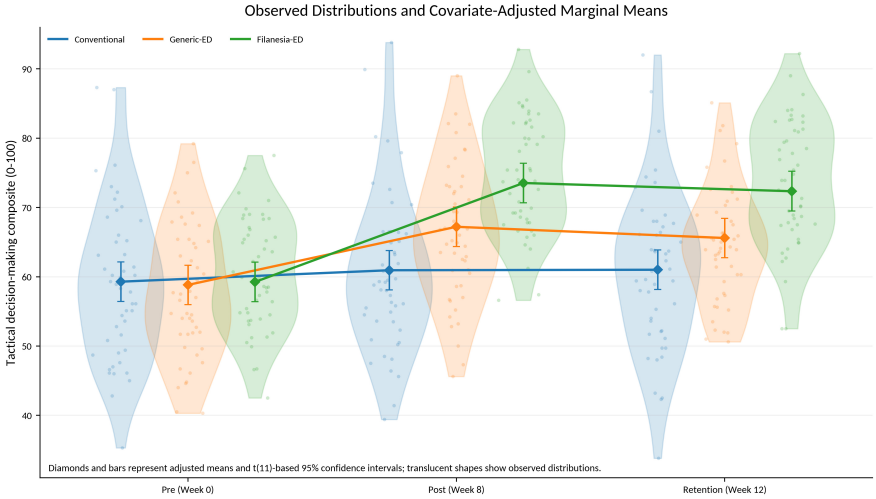


Figure 2. Observed distributions and covariate-adjusted marginal means for tactical decision-making. Diamonds and error bars represent covariate-adjusted marginal means and their reported 95% confidence intervals.

Baseline distributions overlapped. Posttest and retention trajectories favored Filanesia-ED; conventional scores changed little (Figure 2).

The condition × time interaction was Wald $\chi^2(4) = 363.83$, $p < .001$ (Table 3). The model converged (residual SD 2.54), with acceptable residual diagnostics. Attendance and baseline-intelligence sensitivity models yielded similar estimates. Planned contrasts used t(11); incomplete team-level covariance documentation limits certainty about interval precision.

Table 3. Covariate-Adjusted Marginal Means and Planned Tactical Decision-Making Contrasts

Estimate	Condition/contrast	Time	Value	95% CI
Marginal mean	Conventional	Pre	59.29	56.44, 62.14
Marginal mean	Conventional	Post	60.94	58.09, 63.79
Marginal mean	Conventional	Retention	61.01	58.16, 63.86
Marginal mean	Generic-ED	Pre	58.82	55.97, 61.67
Marginal mean	Generic-ED	Post	67.21	64.36, 70.06
Marginal mean	Generic-ED	Retention	65.59	62.74, 68.44
Marginal mean	Filanesia-ED	Pre	59.25	56.39, 62.12
Marginal mean	Filanesia-ED	Post	73.53	70.66, 76.39
Marginal mean	Filanesia-ED	Retention	72.34	69.48, 75.21
Difference	Filanesia-ED - Conventional	Post	12.59***	8.51, 16.67
Difference	Filanesia-ED - Generic-ED	Post	6.32**	2.25, 10.39
Difference	Generic-ED - Conventional	Post	6.27**	2.22, 10.32
Difference	Filanesia-ED - Conventional	Retention	11.33***	7.25, 15.41
Difference	Filanesia-ED - Generic-ED	Retention	6.75**	2.68, 10.83
Difference	Generic-ED - Conventional	Retention	4.57*	0.53, 8.62

*Note. Contrast confidence intervals use a t(11) reference. Symbols indicate nominal model-based significance: * p < .05; ** p < .01; *** p < .001.*

At posttest, Filanesia-ED exceeded conventional coaching by 12.59 points (95% CI [8.51, 16.67]) and Generic-ED by 6.32 (95% CI [2.25, 10.39]); corresponding retention differences were 11.33 (95% CI [7.25, 15.41]) and 6.75 (95% CI [2.68, 10.83]). Generic-ED also exceeded conventional coaching at both times. The nine domain analyses were exploratory.

Multidomain Tactical Adaptation

Figure 3 presents the nine baseline-SD-standardized pretest-to-posttest differential changes relative to conventional coaching; reversed latency makes positive effects indicate faster decisions.

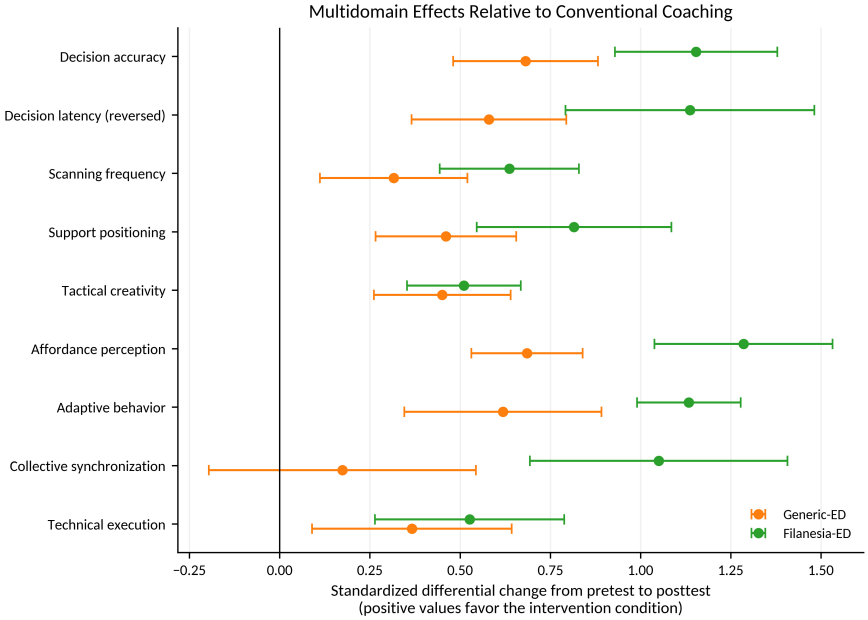


Figure 3. Standardized differential pretest-to-posttest changes across tactical domains relative to conventional coaching. Points are estimates and bars are 95% confidence intervals.

Filanesia-ED showed positive estimates for all nine domains (Figure 3), largest for affordance perception (1.29 SD), accuracy (1.15), reversed latency (1.14), adaptability (1.13), and synchronization (1.05). Generic-ED generally had smaller estimates, except for creativity; its synchronization CI crossed zero. Without reported adjusted p-values, these profiles are descriptive, not nine confirmatory effects.

Decision Accuracy Across Opponent-Pressure Levels

The secondary GEE analyzed 9,806 coded match decisions, adjusting for phase, decision type, match, and baseline tactical intelligence, with team as cluster. Table 4 presents odds ratios and adjusted probabilities; Figure 4 displays the pressure categories.

Table 4. Adjusted Decision Correctness by Opponent-Pressure Level

Condition	Pressure	Adjusted probability	OR vs conventional	95% CI for OR
Conventional	Low	.767	1.00	Reference
Generic-ED	Low	.858	1.84***	1.40, 2.42
Filanesia-ED	Low	.892	2.52***	2.14, 2.96
Conventional	Moderate	.752	1.00	Reference
Generic-ED	Moderate	.778	1.16	0.90, 1.50
Filanesia-ED	Moderate	.831	1.63***	1.50, 1.77
Conventional	High	.633	1.00	Reference
Generic-ED	High	.690	1.29	0.99, 1.68
Filanesia-ED	High	.751	1.74***	1.33, 2.27

*Note. OR = odds ratio; CI = confidence interval. Odds-ratio intervals use a t(11) reference; *** p < .001 indicates nominal model-based significance. Confidence intervals for adjusted probabilities are not reported.*

Correct-decision probabilities declined as pressure increased (Figure 4). At high pressure, estimates were 75.1% (Filanesia-ED), 69.0% (Generic-ED), and 63.3% (conventional). Low-to-high declines were 14.1, 16.8, and 13.4 percentage points, respectively; thus, higher Filanesia-ED accuracy at high pressure does not establish less sensitivity to increasing pressure. Moderate/high-pressure Generic-ED OR intervals included unity; all inferences require caution with 12 clusters.

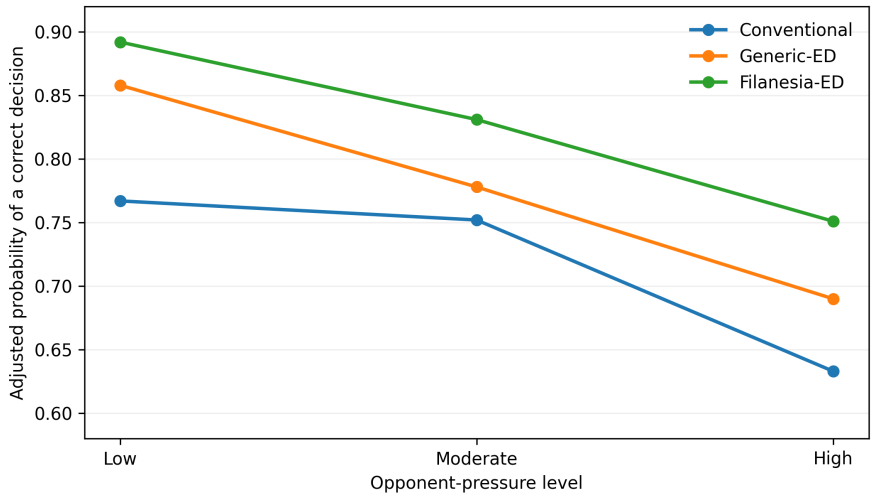


Figure 4. Adjusted probability of a correct decision as opponent pressure increased. Point estimates are shown without probability-level confidence bands; odds-ratio intervals are reported in Table 4.

Implementation Fidelity

Figure 5 displays six observed fidelity dimensions across 16 sessions; pooled scale consistency was α = .950.

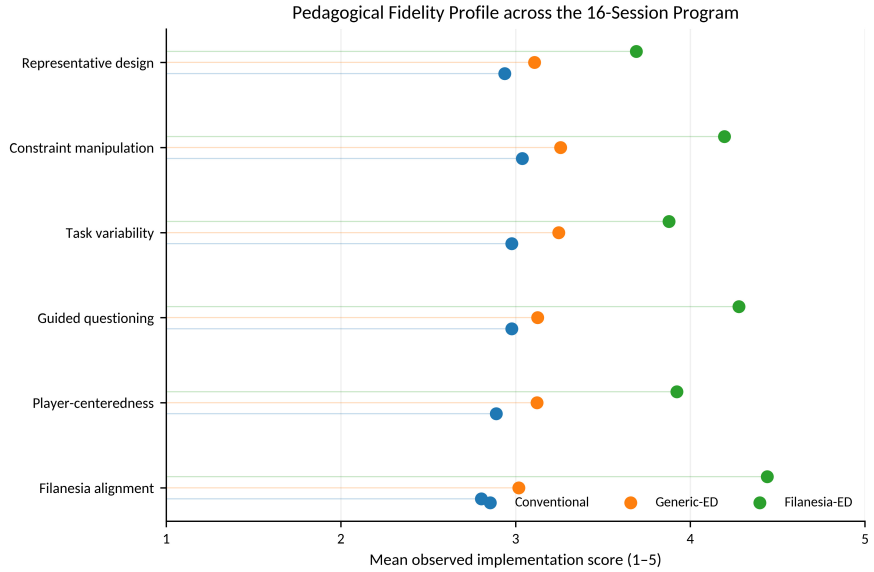


Figure 5. Mean pedagogical-fidelity profile across the 16-session program. Scores ranged from 1 (low implementation) to 5 (high implementation).

Filanesia-ED scored highest for representative design (3.69), constraint manipulation (4.20), variability (3.88), questioning (4.28), player-centeredness (3.92), and Filanesia alignment (4.44; Figure 5). Generic-ED modestly exceeded conventional practice on common dimensions. Unblinded ratings describe delivery differences, not mediation.

Tactical-Physical Coupling

Figure 6 displays descriptive tactical-efficiency patterns against high-speed running; exploratory GEE additionally adjusted for load, sprint distance, position, and physical capacity.

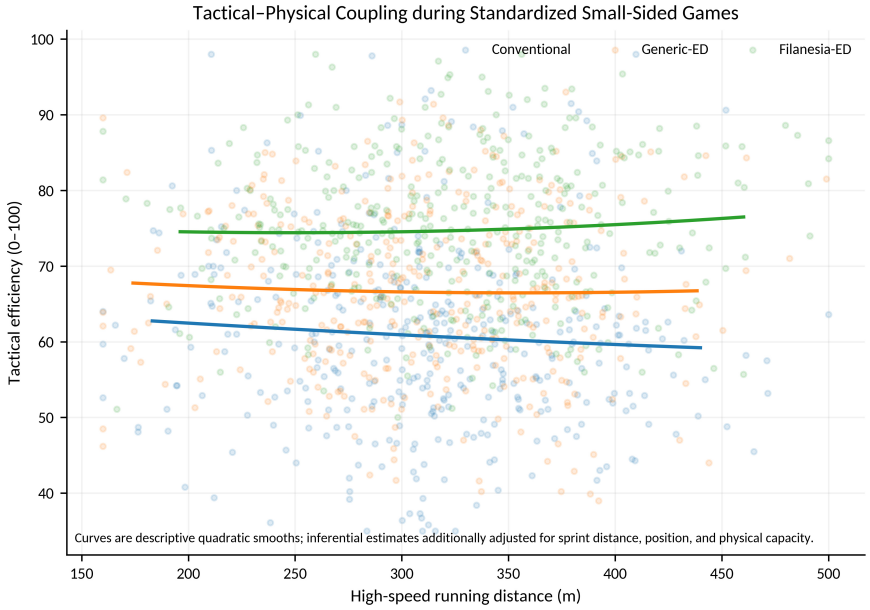


Figure 6. Tactical-physical coupling during standardized small-sided games. Curves are descriptive quadratic smooths; inferential estimates were additionally adjusted for load, sprint distance, position, and physical capacity.

Filanesia-ED had higher descriptive tactical efficiency across much of the observed running range (Figure 6). Mean player load was 409.95 AU (conventional), 408.29 (Generic-ED), and 415.70 (Filanesia-ED). The adjusted Filanesia-ED contrast was 11.17 points (95% CI [−0.96, 23.30], p = .068, t (11) reference); the load interaction was nonsignificant. The interval includes the null, precluding a confirmatory efficiency claim.

Discussion

The primary longitudinal results favored Filanesia-ED, with broadly compatible descriptive patterns in the tactical domains, decision events, and implementation-fidelity measures. Filanesia-ED was associated with the largest post-intervention improvement in the tactical decision-making composite, retained most of that gain four weeks later, and exceeded both Generic-ED and conventional coaching. Exploratory point estimates favored Filanesia-ED across all nine tactical domains; they should not be interpreted as nine independently confirmed effects. The pressure and fidelity profiles are compatible with more functional coordination, but they do not identify a causal learning mechanism or eliminate coach- and academy-level explanations.

The comparison with Generic-ED is especially informative because both ecological conditions used representative and variable practice. The additional advantage observed for Filanesia-ED is compatible with a contribution from organizing practice around shared tactical intentions, although this mechanism was not isolated experimentally. Nevertheless, this remains a treatment-package contrast rather than a mediation test: coach behavior, prior familiarity with the national framework, and other unmeasured academy-level characteristics may have contributed to the observed separation.

The size and persistence of the primary effect are compatible with recent intervention evidence showing that tactical-principle and small-sided-game programs can improve perceptual-cognitive and perceptual-motor decision-making in youth football (Machado et al., 2024). Shorter randomized training has also produced improvements in soccer-specific skill when one-versus-one situations and small-sided games are combined, although effects may depend on the outcome and exposure dose (Sørensen et al., 2024). The four-week retention assessment adds information about the persistence of the observed performance differences after the structured intervention. Retention is important theoretically because temporary performance enhancement can occur through task familiarity,

motivation, or recent cueing without indicating a durable reorganization of perception-action relations.

Generic-ED showed larger gains than conventional coaching, a pattern consistent with possible benefits of representative and variable game-based practice. Filanesia-ED generated an additional advantage, which is compatible with the proposition that ecological pedagogy can become more coherent when task constraints are organized around a shared tactical language and set of playing intentions. This interpretation aligns with complexity-oriented arguments that development frameworks cannot simply be copied as decontextualized templates; they must be inhabited and adapted within the sociocultural system in which players and coaches learn (O'Sullivan et al., 2023, 2025; Wood et al., 2023). In this design, Filanesia specified which collective problems were prioritized, while ecological dynamics structured how those problems were represented and explored in practice.

The exploratory domain profiles are consistent with changes across several tactical behaviors rather than an effect confined to the composite score. Scanning enables players to update information about teammates, opponents, and space before the ball arrives, and more frequent scanning has been associated with more successful subsequent actions under pressure (Hintermann et al., 2024). Youth decision-making also depends on executive control, option quality, and inhibitory stability (Heisler et al., 2023; Matsutake et al., 2024), while differences in functional brain organization have been related to soccer experience and decision accuracy (Li et al., 2024). The favorable exploratory estimates for scanning, latency, accuracy, and positioning are theoretically compatible with improved information pickup and action regulation; they do not, in themselves, establish a neurocognitive mechanism.

Event-level analyses assessed how decision correctness varied with operationalized opponent pressure. Higher pressure categories were associated with lower adjusted probabilities of correct decisions in each condition. Nevertheless, Filanesia-ED maintained the highest adjusted probability under high pressure. Acute research shows that pressure rules alter physiological demand and tactical organization during small-sided games (Chen et al., 2023), and qualitative work with international players indicates that skilled decision-making involves actively manipulating interactions, disguising intentions, and matching choices to action capabilities (Ramsey et al., 2025). Contextual performance models likewise improve when pressure, teammate availability, and positional information are incorporated rather than evaluating actions in isolation (Peters et al., 2024). Accordingly, the evidence supports higher adjusted decision accuracy in the high-pressure category, not a demonstrated reduction in sensitivity to increasing pressure. A formal comparison of condition-specific pressure gradients would be needed to support the latter interpretation.

Positive exploratory estimates for tactical creativity and adaptive behavior are consistent with findings from constraint-manipulation research. Youth players explore different movement solutions when the number and creative profile of opponents change, and smaller numerical formats can increase the emergence of creative actions (Santos et al., 2023; Ueda et al., 2023, 2025). De Joode et al. (2023) similarly demonstrated that task constraints can shape creative action without reducing creativity to a simple frequency count. These studies offer a plausible theoretical interpretation of the observed differences: Filanesia-ED emphasized exploration of functional solutions within shared tactical intentions, rather than rehearsal of a single prescribed sequence.

The fidelity profile describes delivery differences accompanying the reported outcomes, without identifying a causal pedagogical mechanism. Filanesia-ED showed stronger representative design, constraint manipulation, task variability, guided questioning, player-centeredness, and alignment with the intended tactical framework. Experimental work demonstrates that explicit and implicit instructions produce different tactical adaptations, while the interaction between coach instruction and game design changes individual involvement and cooperative passing behavior (Abreu et al., 2024; O'Brien-Smith et al., 2025). The recent systematic review by Morais et al. (2026) also highlights the limited longitudinal evidence concerning instructional constraints. The fidelity ratings provide a descriptive account of differences in intervention delivery, but they cannot establish mediation or disentangle coaching style from intervention content.

Collective synchronization and support positioning deserve particular attention because football decisions are interdependent. Tactical behavior is shaped by team spacing, interpersonal relations, numerical configuration, and formation, not only by the ball carrier's isolated choice (Coito

et al., 2022; González-Rodenas et al., 2025). Comparisons of full- and small-sided games show that formats reorganize transitions, spatial management, ball circulation, and decision speed across youth age groups (Silvino et al., 2024). Played-form pedagogy emphasizes aligning task content and context so that relevant collective interactions can emerge (Petiot et al., 2026). Positive synchronization and support estimates in Filanesia-ED are consistent with more coordinated perception and action, but remain exploratory and do not independently establish retained domain-level learning.

The tactical-physical analysis did not provide confirmatory evidence that improved decision quality was independent of workload, although the descriptive pattern favored Filanesia-ED. Relative area, pitch dimensions, age, pressure rules, and player number can substantially alter external and physiological load (Castillo-Rodríguez et al., 2023; Clemente, et al., 2022; Clemente et al., 2023; de Dios-Álvarez et al., 2025; Santos et al., 2024). Acute load can also affect perceptual-cognitive performance, and higher decision requirements may change ball control, passing, and locomotor output simultaneously (Coutinho et al., 2023; Skala & Zemková, 2023). The present confidence interval was broad and included the null, so future work should test tactical-physical coupling with more teams and prospectively specified load models.

Implications

The findings motivate evaluation of Filanesia tactical intentions within representative, constraints-led youth practice. With four teams per condition and a package-level comparison, practical transfer beyond the studied settings remains provisional.

Research Contribution

This three-arm design separates generic representative pedagogy from practice organized around Filanesia intentions. It integrates immediate and retained composite scores, exploratory domains, pressure-stratified events, fidelity, and tactical–physical observations while acknowledging cluster-level uncertainty. Its contribution is an integrated evaluation of a culturally situated coaching package, not confirmation of its specific causal components.

Limitations

Only 12 teams were randomized; a team-level covariance estimator and primary outcome ICC were not reported, and nominal player/event counts do not eliminate cluster uncertainty. Prospective cluster-based power, randomization block size, allocation concealment, and screening flow were not documented. The composite outcome formula, full match protocol, pitch–roster pairings, GPS thresholds, physical-capacity measures, and tactical-efficiency algorithm were insufficiently specified for independent replication. Coaches were nested within conditions; academy heterogeneity, sex imbalance, unblinded fidelity ratings without inter-rater estimates, and 13 players below the curricular age boundary further limit interpretation. The pressure definition excluded defender orientation and available options; events were not assessed longitudinally. Domain and tactical–physical findings are exploratory. Replication should involve more teams, complete methods, and longer competitive follow-up.

Suggestions

For coaching, a pragmatic sequence is to specify a phase-of-play intention, design a representative game, manipulate salient constraints, ask concise questions, and evaluate decisions as complexity increases. Counter-attack constraints may use time and numerical relations (Rochael & Praça, 2024); dual tasks require caution because they can reduce tactical performance (Moreira et al., 2025; Rezende & Praça, 2025). Future trials should increase team clusters, prespecify analysis and outcomes, document protocols, and test competitive transfer. Fidelity observations can guide coach development.

CONCLUSION

Among 12 randomized youth football teams, Filanesia-ED had the largest posttest tactical decision-making gains and retained an advantage over Generic-ED and conventional coaching four weeks later. Exploratory domains and high-pressure accuracy were favorable, but do not establish specific mechanisms or lower sensitivity to rising pressure. Fidelity documented intervention

differences. Replication requires more teams, longer competitive follow-up, and complete outcome-scoring and cluster-inference documentation.

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AUTHOR CONTRIBUTION STATEMENT

Individual author contributions are withheld from this anonymized review manuscript.

AI DISCLOSURE STATEMENT

ChatGPT (OpenAI) was used to assist with English-language editing, manuscript organization, and document formatting. Responsibility for the accuracy, integrity, and final approval of the manuscript rests with the authors.

CONFLICTS OF INTEREST

The authors declare no financial, institutional, or personal conflicts of interest that could have influenced the conduct, analysis, interpretation, or reporting of this study.

DATA AVAILABILITY STATEMENT

De-identified analytical data and analysis code may be made available by the corresponding author upon reasonable request, subject to institutional ethics approval, parental consent and player assent, and applicable institutional or federation data-sharing restrictions.

ETHICAL APPROVAL

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the Department of Sports Coaching Education, Universitas Negeri Medan (official approval letter dated 28 August 2024, No. 671-A/UN33-10/PKO/2024). Written informed consent was obtained from each participant's parent or legal guardian, and written assent was obtained from each player before assessment. Academy and provincial football association permissions were also obtained.

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