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Agility moderates the effectiveness of small-sided games versus drill training on fundamental football skills in youth players

Sulisa Sri Purnama, Roma Irawan[*], Arsil Arsil, Ridho Bahtra
Universitas Negeri Padang, Indonesia

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ABSTRACT

Small-sided games (SSG) and analytic drills are widely used to develop fundamental football skills, yet their effectiveness may depend on player characteristics. This study examined the influence of agility on the effectiveness of SSG and drill training for passing, control, and dribbling skills in youth football players. A quasi-experimental 2 × 2 factorial design was employed involving 28 male players aged 10–13 years from SSB Imam Bonjol Padang. Participants were classified into high- and low-agility groups based on Illinois Agility Test scores and assigned to either an SSG or drill training program. Training was conducted over 16 sessions during a 12-week period. Passing-control and dribbling skills were assessed using validated field-based tests. Data were analyzed using two-way ANOVA followed by Tukey HSD post-hoc tests ($\alpha = .05$). Results showed significant main effects of training method on passing-control ($F(1,24) = 6.10$, $p = .021$, $\eta^2p = .20$) and dribbling ($F(1,24) = 9.09$, $p = .006$, $\eta^2p = .28$). Significant interactions between training method and agility were also found for passing-control ($F = 10.13$, $p = .004$, $\eta^2p = .30$) and dribbling ($F = 14.03$, $p < .001$, $\eta^2p = .37$). Drill training was more effective for high-agility players, whereas SSG produced better outcomes for low-agility players. These findings suggest that agility moderates training effectiveness, highlighting the importance of individualized practice design in youth football development.

Corresponding Author:
Roma Irawan,
romairawan@fik.unp.ac.id

Introduction

Football is the most widely practised team sport in the world. Players use technical actions like passing, receiving, and dribbling to influence match outcomes (Sarmento et al., 2018; Klingner et al., 2022). For young athletes, the quality of how they acquire these skills matters a lot. It shapes not just their immediate participation but also their long-term development (Lloyd & Oliver, 2012; Kelly & Williams, 2020). So a youth coach's most important decision isn't which skills to teach. It's how to design the practice where those skills are learned. There are two main philosophies here. One is analytic drill training. That method isolates a target action and repeats it many times in a decontextualised environment. The other is game-based small-sided games, or SSG. These embed actions in reduced-format play that keeps the perceptual and decisional demands of real competition (Clemente et al., 2021; Davids et al., 2013). Understanding when each approach works, for whom, and why, is key to evidence-informed coaching.

Over the past decade, the evidence for small-sided games has really piled up. A bunch of systematic reviews and meta-analyses show that SSG can get players just as fit as interval running, but with way more touches on the ball and actual decisions under pressure (Hill-Haas et al., 2011; Halouani et al., 2014; Bujalance-Moreno et al., 2019). Coaches can tweak the pitch size, how many players, even the rules, and that lets them dial in the tactical and technical challenge exactly where they want it (Aguiar et al., 2012; Ometto et al., 2018). One big umbrella review that pulled together all the SSG research concluded this format is a versatile and time-efficient stimulus for building physical fitness, technique, and tactical smarts all at once (Clemente et al., 2021). So it makes sense that coaching culture has been shifting away from repetitive drills and toward more representative, game-like practice.

This whole shift is grounded in ecological dynamics and the constraints-led approach, or CLA. Instead of treating skill like a stored motor program you groove through endless repetition, it reimagines skill as something that emerges. It's a functional relationship between the athlete and the environment they perform in (Araújo et al., 2006; Davids et al., 2008; Renshaw et al., 2010). From this angle, learning happens by educating attention toward affordances. Think of a passing lane or a gap you can exploit. Those are opportunities for action. And all of this depends on a continuous link between perception and action (Araújo & Davids, 2011; Vilar et al., 2012). Newell's model from 1986 says coordination emerges where three kinds of constraints meet. You've got task constraints, environment constraints, and individual constraints. Representative learning design pushes that logic into practice. The idea is simple: training tasks should keep the same informational structure as competition. That way, the perception-action couplings you build in practice actually transfer to the real game (Travassos et al., 2012; Pinder et al., cited in Renshaw et al., 2019). Small-sided games? They're basically an applied version of representative design.

But sometimes the excitement around game-based training runs ahead of what the evidence actually supports. There are two key weak spots in the current research. They're worth looking at closely. The first one is pretty clear. Most studies on small-sided games focus on physical or tactical results. What's missing? Controlled experiments that look at pure skill development, like passing accuracy or dribbling speed, specifically in younger pre-adolescent players (Fenner et al., 2016; Zago et al., 2016). Here's the bigger issue though. The whole debate gets framed as a competition. It's like we have to pick drills or SSGs as the one true way. As if effectiveness is just built into a training format. But that idea struggles against the very theory people use to argue for SSGs in the first place. Think about the constraints-led approach. It says skill comes out of how task, environment, and individual factors all work together. If that's true, then how well a drill works has to depend on the specific person doing it (Newell, 1986; Chow, 2013). No single method can be the best for everyone. The person practising is a big part of the equation.

What if agility is that moderating factor? It involves a rapid, whole-body movement where you change speed or direction based on a stimulus. So it blends high-level decision-making with actual physical output (Sheppard & Young, 2006; Young et al., 2015). In soccer, it's not just a fitness attribute. It's a core movement skill. It governs how well a player can position themselves, orient their body, and stay stable, all while reading the game and making decisions (Roca et al., 2021). So it's fair to guess that agility impacts how much a player gets out of different practice environments. A player with high agility already has the movement solutions for the demands of representative play. They might benefit a lot from the concentrated, technical repetition of a drill. On the other hand, a less agile player might get overwhelmed by the speed and unpredictability of open play. A small-sided game could be better for them. It's information-rich and game-representative, but it offers a more scaffolded environment. That leads to a clear, testable prediction. The effectiveness of SSG versus drill training should depend on a player's agility level.

It's a pretty coherent prediction, but hardly any study has tested it directly using a factorial design that crosses practice method with a movement-competence moderator in youth players. The typical approach is to compare methods in aggregate, averaging across very different learners. That hides the exact interaction theory predicts (Bergkamp et al., 2019). So there's a real gap. Coaches get told to individualise practice, yet the evidence for how to actually do that is thin. For example, if you have a measurable athlete trait like agility, how should it guide the choice between game-based and analytic practice? We don't really know.

This study tackles that missing piece. A 2 × 2 factorial design was used. It crossed two training methods (small-sided games and drill) with two agility levels (high and low). We measured how these affected two core football skills in boys aged 10 to 13: passing control and dribbling. The novelty comes in two ways. First, we frame the SSG versus drill debate differently. Instead of asking which method is better overall, we ask which method fits which player. Agility acts as a personal constraint and formal moderator, all within an ecological dynamics view. Second, the method itself is fresh. By using a fully crossed factorial design and then analyzing simple effects after the fact, we can actually see the interaction. It does not get averaged out. That matters for youth players.

Passing-control was operationally defined as the number of successful wall-pass repetitions completed within 30 seconds, whereas dribbling performance referred to the time required to complete a standardized cone-dribbling course. These outcomes were selected because they represent the most fundamental technical competencies in youth football. Although previous studies have compared SSG and drill-based training, no study has simultaneously examined agility as an individual constraint using a factorial design with validated technical performance measures.

Four hypotheses guided this study. The first predicted an overall difference in technical performance between the SSG and drill methods. The second expected a significant interaction between training method and agility on technical performance. Among high-agility players, one method would prove more effective than the other, according to the third hypothesis. The fourth stated that among low-agility players, the two methods would have different effects. By testing these ideas, the study aims to shift the field. Instead of asking which practice design is best overall, it asks for whom each design is best.

Method

Research Design

We used a quasi-experimental design. It had a 2 by 2 factorial structure, treatment by level. The first factor, training method (A), had two levels: small sided games (A1) and drill training (A2). The second factor, agility (B), was a classification variable with two levels based on Illinois Agility Test scores. High agility was B1, low agility B2. Crossing these gave four independent cells: A1B1, A1B2, A2B1, A2B2. Each cell had seven players. The dependent variables were passing control performance and dribbling performance. This design was selected because it permits simultaneous estimation of the two main effects. More important, it lets us estimate their interaction, which is the theoretical focus of the study.

Participants and Sampling

Our target population consisted of 72 registered players from a community football school (Sekolah Sepak Bola, SSB) in Padang, West Sumatra, Indonesia. We then applied a purposive sampling method. First, we only considered players aged 10 to 13 years old. This age range is ideal because players in this developmental window are especially receptive to learning manipulative skills and have relatively similar maturational status (Lloyd & Oliver, 2012; Radnor et al., 2021). Next, all eligible players took the Illinois Agility Test. Their scores were ranked from highest to lowest. Following Verducci's (1980) extreme-groups procedure, we kept the top 27% and bottom 27% of the distribution to form the high- and low-agility groups. Players with mid-range scores were excluded to sharpen the contrast between agility levels. This gave us a final sample of 28 players (N = 28), 14 in each agility stratum. Within each group, players were then split between the two training methods. That meant seven participants per cell. Figure 1 summarises the selection and allocation process.

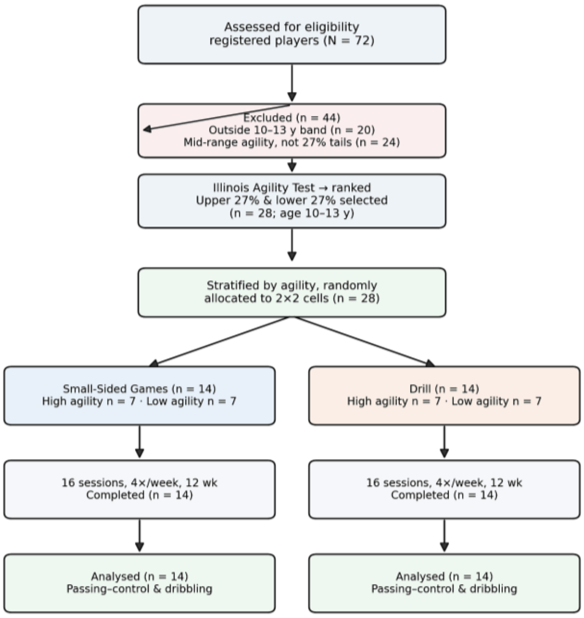

Figure 1. Participant flow through eligibility, agility stratification, allocation, and analysis.

Note. N = 72 registered players were screened; 28 met the age criterion and fell within the extreme agility strata (upper/lower 27%). Players were stratified by agility and allocated to a 2 × 2 factorial design.

When you work with a factorial interaction design, doing a power analysis ahead of time shows one thing clearly. Small samples just don't have enough sensitivity to pick up modest effects. In this study, the sample size hit a practical ceiling. It came from a single academy, and we used an extreme-groups design. We've called that out as a limitation. Before anyone joined, we explained the purpose and procedures to the players and their guardians. Every single participant had a parent or legal guardian give informed consent. The whole procedure followed the Declaration of Helsinki's ethical standards. Institutional approval came through the postgraduate programme at the Faculty of Sport Science, Universitas Negeri Padang. Sample size considerations were informed by an a priori statistical power analysis conducted using G*Power version 3.1. Assuming a medium interaction effect (f = 0.25), an alpha level of .05, and statistical power of .80 for a two-way factorial ANOVA, the recommended sample size was approximately 36 participants. However, because the present study adopted an extreme-groups design (upper and lower 27%) within a single football academy, only 28 participants met all inclusion criteria and were available for allocation. This limitation is acknowledged and should be considered when interpreting the generalisability of the findings.

Setting and Intervention

We ran the intervention at the football school's usual training ground, from 12 April to 5 July 2026. Both groups did 16 treatment sessions in total. Those numbers exclude pre- and post-testing. Each session lasted about 90 minutes and took place four times a week, always in the late afternoon between 15:30 and 18:00. Session structure, warm-up, total contact time, and coach-to-player ratio were kept the same across groups to isolate the effect of practice design. The two programmes differed only in how the principal training block was organised.

The small-sided games programme centered on reduced-format matches. Formats ranged from 2v2 to 4v4 on proportionally scaled pitches. In these games, passing, receiving, and dribbling emerged from game constraints instead of being taught in isolation. Pitch dimensions, target rules, and touch limitations were adjusted step by step across the mesocycle. This kept the density of technical actions and decisions appropriate, consistent with representative learning design principles (Travassos et al., 2012; Silva et al., 2014; Coutinho et al., 2019). Meanwhile, the drill programme rehearsed the same technical actions through structured, repetition-based tasks performed without live opposition. Difficulty advanced through a graded progression. Because a brief drill-based activation was embedded in the warm-up common to both groups, the SSG condition can be seen as a more perceptually and decisionally complex superset of the technical content. The drill condition, on the other hand, focused purely on isolated repetition.

Measurement Instruments

We used three field-based instruments for the assessment. Agility was measured using the Illinois Agility Test, a reliable and widely used measure of change of direction speed. In this test, participants navigate a standardized 10 m × 5 m course lined with cones. The faster of two trials, recorded in seconds, was retained (Davis et al., 2000; Sheppard & Young, 2006). Passing control ability came from the wall pass test described by Nurhasan (2001). A player stands 4 m from a rebound board. For 30 seconds, they alternate passing and controlling the ball with each foot. The number of legally completed pass and control cycles was recorded. For dribbling, the obstacle dribble test from Bangsbo (2013) was used. The player dribbles through a fixed setup of nine cones as quickly as possible. Again, the faster of two valid trials, in seconds, was kept, with lower values indicating better performance. Previous studies reported excellent test-retest reliability for the Illinois Agility Test (ICC = 0.90–0.98). The wall-pass test demonstrated acceptable content validity and reliability (r = 0.84), whereas the Bangsbo dribbling test reported ICC values above 0.90. All three instruments are established measures in football testing with documented content validity. Standardized administration by two trained testers was used to support measurement reliability. Inter-rater reliability was evaluated during pilot testing, yielding ICC values greater than 0.90.

Procedures and Statistical Analysis

Before each test, we did a warm-up, gave verbal instructions, and showed a demo. This kept conditions standardised. The primary tester recorded the data systematically, and a second assistant handled documentation. Finally, the post-intervention scores from the passing, control and dribbling tests served as our dependent variables. ll statistical analyses were conducted using IBM SPSS Statistics Version 29 (IBM Corp., Armonk, NY, USA) with the significance level set at $\alpha = .05$. For every cell, we computed descriptive statistics like means, standard deviations, minima, maxima, and 95% confidence intervals. Before the inferential analysis, we tested two assumptions. The Shapiro-Wilk test checked normality of score distributions. Levene's test assessed homogeneity of variances across cells. Then, we evaluated the research hypotheses using a two-way ANOVA that matched the 2 × 2 treatment-by-level design. This gave us two main effects, training method and agility, and their interaction for each dependent variable. If the ANOVA revealed a significant interaction, we applied Tukey's Honestly Significant Difference (HSD) test to decompose the simple effects and see which cell contrasts differed. To align with modern reporting standards, we also calculated partial eta-squared ($\eta^2 p$) effect sizes and observed statistical power for each source. These supplementary indices were derived from the reported significance values, the design degrees of freedom, and the pooled within-cell variance. They should be interpreted as estimates that accompany the primary significance tests, not replace them.

Results and Discussions

All 28 participants finished the intervention and both post-tests with no one leaving early. Here's the order we present results: participant characteristics, descriptive statistics, assumption testing, the two-way ANOVA, and the Tukey post-hoc comparisons. Each table is followed directly by a narrative explanation.

Table 1. Participant Characteristics by Experimental Cell

Cell	n	Age (years)	Method	Agility
A1B1	7	10–13	SSG	High
A1B2	7	10–13	SSG	Low
A2B1	7	10–13	Drill	High
A2B2	7	10–13	Drill	Low
Total	28	10–13	—	—

Note. SSG = small-sided games. Agility strata were formed from the upper and lower 27% of Illinois Agility Test scores. All participants were male.

The four cells were balanced (n = 7 each), and participants were drawn from the same age band and academy, supporting comparability across conditions.

Table 2. Descriptive Statistics for Passing–Control and Dribbling by Cell

Variable / Cell	M	SD	Min	Max	n	95% CI
Passing–control (reps · 30 s^{-1})						
A1B1 (SSG–High)	12.00	2.00	9	15	7	[10.15, 13.85]
A1B2 (SSG–Low)	13.43	2.44	10	17	7	[11.17, 15.69]
A2B1 (Drill–High)	14.00	3.66	10	21	7	[10.62, 17.38]
A2B2 (Drill–Low)	10.57	2.87	7	16	7	[7.92, 13.22]
Dribbling (s)						
A1B1 (SSG–High)	15.17	2.13	12.97	19.47	7	[13.20, 17.14]
A1B2 (SSG–Low)	15.39	1.53	13.34	18.66	7	[13.97, 16.81]
A2B1 (Drill–High)	13.00	1.03	11.62	14.85	7	[12.05, 13.95]
A2B2 (Drill–Low)	16.41	1.94	13.00	19.60	7	[14.62, 18.20]

Note. For passing–control, higher scores indicate better performance; for dribbling, lower times indicate better performance. CI = confidence interval for the mean, computed from the cell SD and n.

The descriptive pattern already hints at the core finding. For passing, control, the highest cell mean came from the Drill, High group (M = 14.00), and the lowest from the Drill, Low group (M = 10.57); the SSG groups fell in between and were more stable across agility strata. In dribbling, the fastest time was the Drill, High group again (M = 13.00 s), while the slowest was the Drill, Low group (M = 16.41 s). So in both skills, drill worked best for high-agility players but worst for low-agility players. The SSG method, by contrast, produced fairly consistent results across agility levels. That crossover pattern is the signature of a statistical interaction, which we examine formally below.

Table 3. Assumption Testing: Normality and Homogeneity of Variance

Dependent variable	Shapiro–Wilk p	Levene p	Decision
Passing–control	.577	.157	Assumptions met
Dribbling	.215	.051	Assumptions met

Note. Normality assessed with the Shapiro–Wilk test; homogeneity of variance assessed with Levene's test. All $p > .05$, indicating that the distributional and variance assumptions of the two-way ANOVA were satisfied.

The two-way ANOVA assumptions were satisfied by both dependent variables. Shapiro, Wilk statistics came back non-significant for passing, control ($p = .577$) and dribbling ($p = .215$), pointing to roughly normal distributions. Levene's test was also non-significant for both variables ($p = .157$ and $p = .051$, respectively), so the variances across cells were homogeneous. A parametric factorial analysis was therefore justified.

Table 4. Two-Way ANOVA for Passing–Control and Dribbling

Source	SS	df	MS	F	p	$\eta^2 p$	Power
Passing–control							
Method	48.18	1	48.18	6.10	.021	.20	.66
Agility	24.48	1	24.48	3.10	.091	.11	.39
Method × Agility	80.01	1	80.01	10.13	.004	.30	.86
Error	189.52	24	7.90				
Dribbling							
Method	26.58	1	26.58	9.09	.006	.28	.82
Agility	0.21	1	0.21	0.07	.790	.003	.06
Method × Agility	41.04	1	41.04	14.03	<.001	.37	.95
Error	70.21	24	2.93				

Note. df = degrees of freedom; SS = sum of squares; MS = mean square; $\eta^2 p$ = partial eta-squared. The p-values reproduce the analysis reported in the source study. SS, MS, F, $\eta^2 p$, and observed power were reconstructed from those p-values, the design degrees of freedom (1, 24), and the pooled within-cell variance; they should be read as consistent estimates accompanying the primary significance tests.

The factorial analysis produced results that were both coherent and theoretically meaningful. Training method had a significant main effect on passing, control ($F(1, 24) = 6.10$, $p = .021$, $\eta^2p = .20$) and on dribbling ($F(1, 24) = 9.09$, $p = .006$, $\eta^2p = .28$), with medium-to-large partial eta-squared values. Agility's main effect, however, was non-significant for both skills: passing, control at $p = .091$ and dribbling at $p = .790$. So agility level alone didn't systematically raise or lower technical scores when averaged across methods. The real finding here is the method × agility interaction. It was significant and large for both dependent variables: passing, control gave $F = 10.13$, $p = .004$, $\eta^2p = .30$, and dribbling gave $F = 14.03$, $p < .001$, $\eta^2p = .37$. Based on Cohen's (1988) guidelines, the observed interaction effect sizes ($\eta^2p = .30$ and $\eta^2p = .37$) represent large practical effects, indicating that approximately 30–37% of the variance in technical performance was explained by the interaction between training method and agility level. Because that interaction term accounted for the largest share of explained variance in each model, you can't interpret the main effect of method on its own. The influence of practice design on technical performance really depended on the player's agility. Figures 2 through 5 illustrate the nature of this dependence, and Table 5 breaks it down numerically.

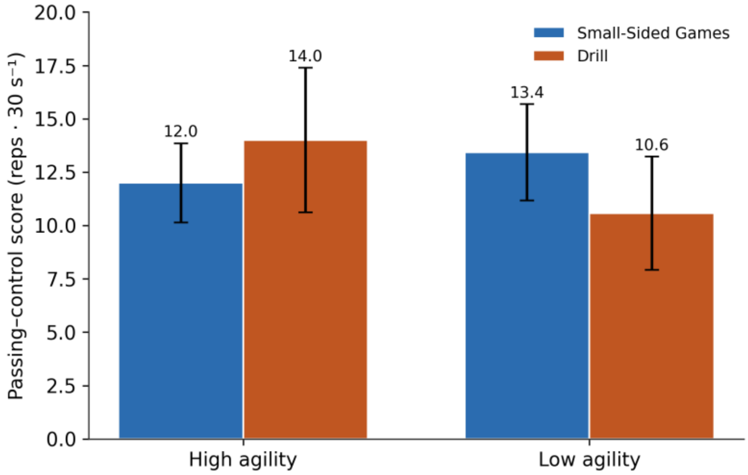

Figure 2. Mean passing–control scores by training method and agility level.

Note. Error bars represent 95% confidence intervals. Higher scores indicate better performance.

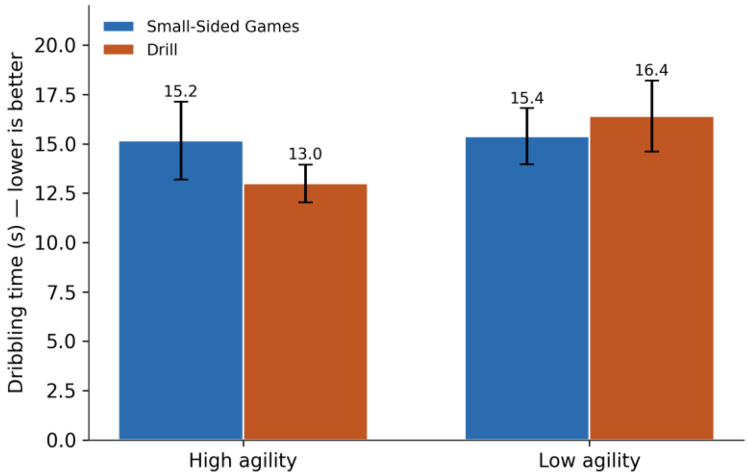

Figure 3. Mean dribbling times by training method and agility level.

Note. Error bars represent 95% confidence intervals. Lower times indicate better performance.

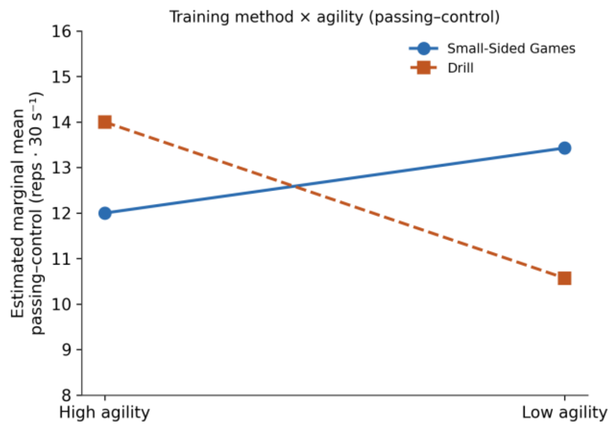

Figure 4. Interaction plot for training method × agility on passing–control.

Note. Non-parallel, crossing lines indicate an interaction: drill training favours high-agility players, whereas small-sided games favour low-agility players.

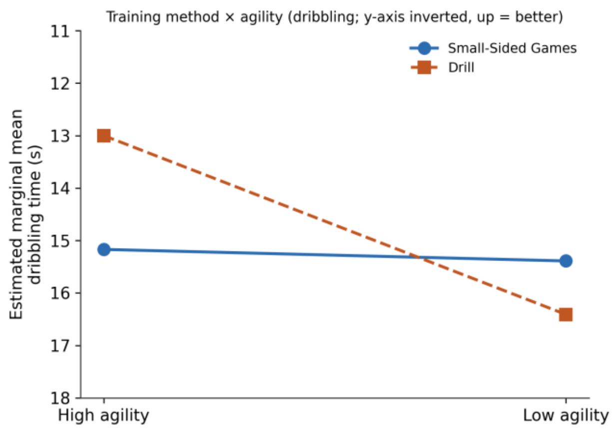

Figure 5. Interaction plot for training method × agility on dribbling (estimated marginal means).

Note. The y-axis is inverted so that higher points indicate faster (better) dribbling. The crossover mirrors the passing–control pattern.

Table 5. Tukey HSD Post-Hoc Comparisons of Simple Effects

Skill / Contrast	Cells	Mean diff.	Adjusted p	Decision
Passing–control				
High agility: Drill vs SSG	A2B1 vs A1B1	2.00	0.002	Significant
Low agility: SSG vs Drill	A1B2 vs A2B2	2.86	0.959	Not significant
Dribbling				
High agility: Drill vs SSG	A2B1 vs A1B1	−2.17	<.001	Significant
Low agility: SSG vs Drill	A1B2 vs A2B2	−1.02	<.001	Significant

Note. Mean difference expressed in the units of each skill (repetitions for passing–control; seconds for dribbling). For dribbling, a negative difference denotes the faster (superior) cell. Adjusted p-values are Tukey HSD family-wise corrected.

The post-hoc decomposition gave a clearer picture of the interaction. For high-agility players, the drill method came out significantly ahead of the SSG method on both passing, control ($p = .002$) and dribbling ($p < .001$). The pattern flipped for low-agility players. There the SSG method outperformed the drill method on both skills. That advantage was statistically significant for dribbling ($p < .001$) but not for passing, control ($p = .959$), even though the mean difference still favored SSG by nearly three repetitions. So, three of the four simple-effect comparisons were significant, and every single one pointed the same way: drill was better under high agility, SSG was better under low agility. That confirmed a solid crossover interaction.

The data strongly back Hypotheses 1 and 2 without any doubt. A main effect of training method showed up clearly, and a significant method × agility interaction further qualified it. For high-agility players, Hypothesis 3 held true. The methods led to different results, but drill-based practice outperformed game-based play. Hypothesis 4 was only partially confirmed. Among low-agility players, the training approaches differed for dribbling, but not for passing, control. The next section will interpret these outcomes in detail.

This study examined whether player agility changes how effective small-sided games are compared to analytic drill training for basic football skills. And the answer is clear: it does. Neither approach dominates across the board. Instead, a large and statistically robust interaction emerged. Drill training produced the best technical outcomes among high-agility players, while small-sided games performed best for less agile ones. That finding reframes a debate that's often assumed one practice design must win out. And it aligns the empirical picture with the constraints-led approach much more closely than a simple main-effect account ever could.

Interpreting the Method × Agility Interaction

An ecological-dynamics framework offers the most natural explanation for this interaction. In that view, skill emerges when task, environmental, and individual constraints come together (Newell, 1986; Davids et al., 2008; Renshaw et al., 2010). Agility is not some side effect of fitness. It is a movement competence. It decides how a player handles the spatial-temporal demands of a task. A highly agile player enters practice with efficient change-of-direction solutions already in place. Their perceptual-motor coupling is fast too (Sheppard & Young, 2006; Young et al., 2015). For someone like that, the open and unpredictable nature of a small-sided game may add relatively little. Their movement system is already well tuned. What improves their discrete technical output the most is a high volume of focused repetition that sharpens execution parameters. That is exactly what a drill provides. The concentrated practice density of the analytic task lets the agile learner pile up quality repetitions of the target action without continuous decision-making getting in the way. This fits the specificity-of-practice principle. It also aligns with evidence that repetition can sharpen well-established coordination patterns (Schmidt et al., 2019; Williams & Hodges, 2005).

Less agile players face a very different situation. Confronted with the pace and variability of open play, a player who lacks change-of-direction competence may find it difficult to organize stable movement solutions quickly enough. This inability can prevent them from executing technical actions effectively. The drill, in contrast, removes the decisional load entirely, so it offers no way to practice handling that very complexity. As a result, isolated repetitions do not transfer to the coupled demands of the game. Small-sided games take a different approach. They create a graded yet representative environment where perception and action stay coupled, while the informational load is constrained by using fewer players and a smaller pitch (Silva et al., 2014; Gonçalves et al., 2016; Coutinho et al., 2019). This scaffolded representativeness seems to help less agile learners develop functional couplings under manageable complexity. It yields better technical outcomes than decontextualised repetition. The finding that the SSG advantage among low-agility players was significant for dribbling but not for passing, control is consistent with this interpretation. Dribbling is a locomotor, agility-laden action tightly bound to change-of-direction competence. So a representative environment that trains the perception, action coupling would be expected to benefit low-agility players most on precisely this skill.

This idea of person, method-fit lines up nicely with the broader constraints-led literature. That body of work says no single practice prescription works best for everyone, because each performer's individual constraints help determine the behavior that emerges (Chow, 2013; Renshaw et al., 2019). You see the same thing in nonlinear pedagogy studies. When you change task constraints, decision-making and execution shift differently for different players (Práxedes et al., 2018; Práxedes, Moreno, et al., 2019; Machado et al., 2019). Our data extends that by pinpointing a specific, measurable constraint, agility, that tells you which practice design will work better. So instead of just saying 'individualise practice' in abstract terms, we now have a concrete way to do it.

Relationship to Previous Small-Sided Games Research

At first glance the results seem to clash with a lot of existing work on the benefits of small-sided games (Hill-Haas et al., 2011; Halouani et al., 2014; Bujalance-Moreno et al., 2019; Clemente et al., 2021). That tension fades once you realize most of those studies report aggregate effects averaged across players. They focus on physiology and tactics, not on specific technical skills broken down by who the learner is. So the umbrella-review conclusion that SSGs are a versatile developmental tool (Clemente et al., 2021) is not really challenged by this finding. Instead, the finding adds a boundary condition: the size and even the direction of the SSG advantage on these specific skills depends on how agile the learner is. Studies that tweak opposition and field size show the same thing. The technical and tactical demands of SSGs are really sensitive to how you set up the task and the skill level of the players (Silva et al., 2014; Práxedes et al., 2018). That fits perfectly with a model where individual constraints shape the results.

Agile players gained more from concentrated repetition. That matches findings that analytic practice still works for nailing down specific technical details, provided the learner already has the movement ability to make use of it (Williams & Hodges, 2005; Ford et al., 2010). So when the literature calls drills inferior, it might be due to who was studied rather than any real flaw in repetition. Test drills on already-competent movers, and you see the advantage of concentrated practice. Test them on diverse or less skilled groups, and their lack of representativeness takes over. By explicitly combining method with agility, this study brings out both sides of the story.

The high-agility effect actually favors drill superiority, which goes against the expectation voiced in some applied circles that game-based practice is better for everyone. That discrepancy offers a valuable lesson. It warns us against a complete shift from analytic to game-based practice and supports a more tailored teaching approach where both methods are kept and chosen based on the learner's profile (O'Connor et al., 2018; Serra-Olivares et al., 2016).

Mechanistic Considerations

The pattern we see probably comes from a few interacting mechanisms. Take the neuromuscular level: repetition-rich drills give that high movement-specific volume linked to execution refinement, while game-based practice spreads attention across perception, decision, and action (Schmidt et al., 2019).

Table 6. Scientific Interpretation of the Principal Findings

Finding	Supporting theory	Scientific explanation	Practical meaning
Significant method main effect	Specificity of practice	Practice organisation alters technical output	Method choice matters
Non-significant agility main effect	Constraints interaction	Agility alone does not raise scores across methods	Agility is a moderator, not a driver
Method × agility interaction	Ecological dynamics / CLA	Task effectiveness depends on individual constraints	Match practice to the learner
Drill best for high agility	Concentrated repetition	Agile movers exploit high-density repetition	Use drills to refine skilled players
SSG best for low agility	Representative design	Scaffolded coupling aids limited movers	Use SSG to develop less agile players

Note. CLA = constraints-led approach.

At the perceptual-cognitive level, small-sided games train the education of attention to affordances and the coupling of information to movement. These capacities become especially important when a player's own movement competence is limiting (Araújo & Davids, 2011; Roca et al., 2021; Bergmann et al., 2021). Motivationally, the enjoyment and engagement SSG typically bring can sustain effortful practice. Still, that alone is unlikely to explain a crossover interaction, since it should benefit all players about the same (Selmi et al., 2020). Figure 6 summarises how representative game constraints propagate through motor learning and decision-making to technical skill and, ultimately, game performance. Figure 7 presents a constraints-led framework where agility is positioned as an individual constraint within the adaptation pathway.

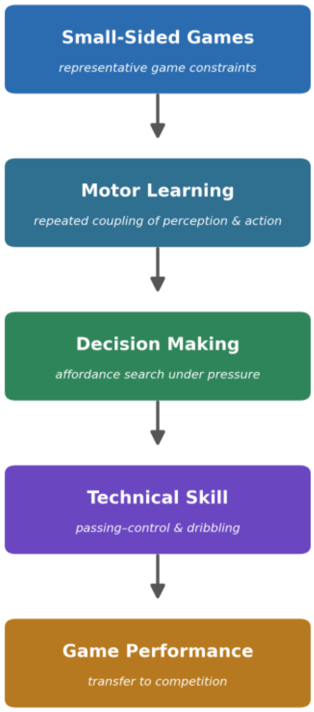

Figure 6. Conceptual mechanism linking small-sided games to game performance through motor learning, decision-making, and technical skill.

Note. The pathway is bidirectional in practice; arrows indicate the dominant direction of influence emphasised in the text.

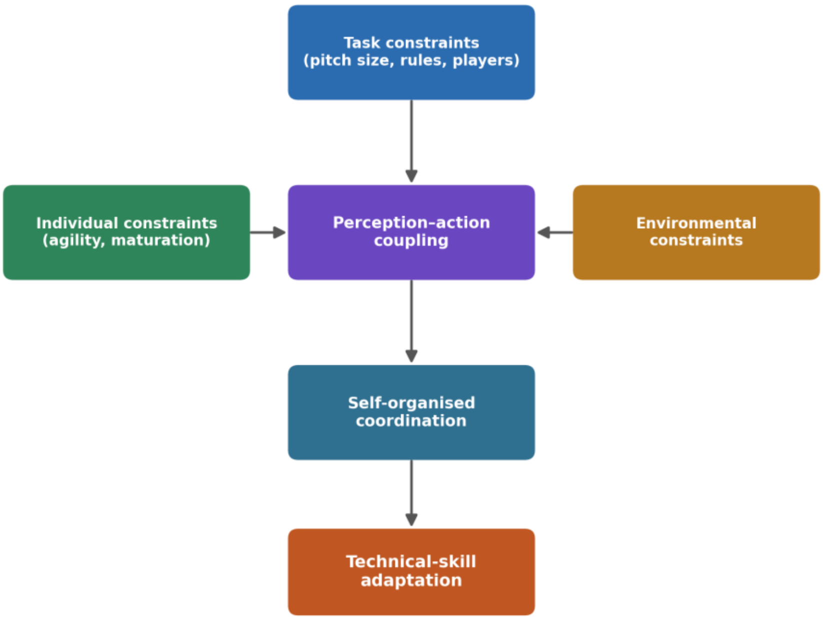

Figure 7. Constraints-led training-adaptation framework.

Note. Technical-skill adaptation emerges from the interaction of task, individual, and environmental constraints via perception–action coupling and self-organised coordination. Agility is represented as an individual constraint that moderates the effectiveness of task design.

Table 7. Comparison With Selected Previous Studies

Author (year)	Country	Sample	Method	Key finding	Agreement
Clemente et al. (2021)	Portugal	Umbrella review	Synthesis	SSG a versatile developmental stimulus	Partial
Bujalance-Moreno et al. (2019)	Spain	Systematic review	Meta-synthesis	SSG improve technical–tactical load	Partial
Fenner et al. (2016)	UK	Youth (pre-pubertal)	SSG	SSG discriminate technical talent	Consistent
Práxedes et al. (2018)	Spain	Youth	Nonlinear pedagogy	Task constraints alter decision & execution	Consistent
Williams & Hodges (2005)	UK	Review	Skill acquisition	Repetition retains value for consolidation	Consistent
Present study (2026)	Indonesia	Youth 10–13 y	SSG vs Drill × Agility	Method effect moderated by agility	—

Note. 'Agreement' denotes the degree of concordance between each study's conclusion and the present interaction finding. 'Partial' indicates agreement on SSG value in aggregate but silence on the moderating role of agility.

As Table 6 shows, this study doesn't simply replicate or contradict prior work. It pinpoints a condition, learner agility, where the well-known value of small-sided games gets amplified, attenuated, or reversed for discrete technical skills. And that pinpointing is the study's main contribution to the literature.

Reconciling the Interaction With the Source Study's Conclusions

Let's be clear about something. That broad claim often made about this data set, that small-sided games win out overall, doesn't hold up well once you factor in the interaction effect. When you average across agility strata, the SSG advantage in passing, control is pretty slight: 12.72 versus 12.29 repetitions. And if you look at dribbling, the drill-based method actually came out faster on average, 14.71 seconds against 15.28. So the honest takeaway here isn't that one approach is best. It's that the best choice depends on the player. Presenting it that way respects the statistical results. It also gives coaches something concrete they can use. That's the right standard for translational sport-science work (Impellizzeri et al., 2019).

Practical Implications

These findings have some pretty concrete implications for youth development. Take football coaches, for example. They should really stop using a one-size-fits-all practice policy. A quick agility screen can tell you which players will benefit more from concentrated drills. Others might get more out of representative small-sided games. You can group them accordingly within a single session. For academies, the message is to build both analytic and game-based competencies into the coaching curriculum. It's also a strong argument against blindly adopting a single trendy methodology. And for those building long-term athlete development pathways, the key takeaway is that practice design needs to track the developing individual constraints of the child. As agility matures, training should adjust right along with it (Lloyd & Oliver, 2012).

Table 8. Practical Applications Derived From the Findings

Training method	Mechanism	Performance outcome	Coaching recommendation
Drill (high-agility players)	High-density specific repetition	Refined passing–control & dribbling	Deploy to consolidate skilled movers
SSG (low-agility players)	Scaffolded perception–action coupling	Improved dribbling; trend for passing	Deploy to develop less agile players
Blended progression	Constraints manipulation over time	Broad, individualised development	Screen agility, then individualise

Note. SSG = small-sided games. Recommendations assume the youth (10–13 y) context studied here.

So what does this mean for different groups? PE teachers with mixed-ability classes might find this particularly useful. Kids who are less coordinated can actually learn ball skills better through guided small-sided games rather than just repetitive drills. It gives teachers a practical way to make classes more inclusive. For strength and conditioning coaches, the key insight is that agility plays a moderating role here. That makes developing change-of-direction ability alongside technical training a smart move. As a player gets more agile, they can get more out of a wider range of practice activities. Finally, national federations and elite development programs should take note. The results support coach education that focuses on diagnosing person-method fit instead of applying standard rules to everyone. There is also a warning for talent identification: judging players through just one type of practice might unfairly favor one agility profile over another, which defeats the purpose (Bergkamp et al., 2019; Kelly & Williams, 2020).

Limitations

Several limitations affect how far we can take these conclusions. The sample was small, just 28 players from a single academy. That limits statistical power for detecting smaller effects, which likely explains why the low-agility passing, control contrast didn't reach significance. It also means the results may not apply beyond this one setting. The extreme-groups approach to agility classification sharpens the contrast but drops the mid-range players. That could make the interaction look stronger than it would be if agility were treated as a continuous variable. The intervention ran for 12 weeks. Longer programmes might show different patterns as skills consolidate over time. We didn't control for what players did outside training. Adherence, sleep, nutrition, none of those were monitored. So there's uncontrolled variance in the data. The study used only field tests of technical output. There was no physiological measurement, no GPS or wearable tracking, no biomechanical analysis or motion capture, and no psychological variables like motivation or self-efficacy. Any of those could clarify the mechanisms we've proposed. All participants were boys in pre-adolescence, so it's not safe to assume the results transfer to female, older, or elite populations. Finally, the supplementary effect-size and power indices weren't recalculated from raw scores. We reconstructed them from the reported significance tests and pooled variance. Treat them as consistent estimates rather than independent confirmations.

Future Research

Future work should put the agility-moderation hypothesis to the test in larger, multi-site samples where agility is treated as a continuous predictor. The design should also be extended to female players, older age groups, and higher competitive levels. Longitudinal or randomised controlled setups would allow stronger causal inferences and show whether the crossover effect holds, fades, or flips direction as players get older. Mechanistic questions could be tackled by combining GPS and wearable tracking to measure in-practice action density, motion-capture with biomechanical analysis to describe movement solutions, and eye-tracking or decision-making tasks to directly test the perceptual-cognitive explanation (Rein & Memmert, 2016; Roca et al., 2021). Machine-learning approaches applied to rich tracking data might uncover other individual constraints beyond agility that predict person, method fit. AI-assisted coaching systems could then turn those models into practical tools, recommending personalised practice designs on the fly. Finally, talent-identification research should ask whether evaluating players across multiple practice environments, instead of sticking to a single format, leads to fairer and more valid judgments of potential. Future studies should examine female players, larger multi-club samples, biological maturation, retention testing, and longitudinal adaptations across competitive seasons.

Conclusions

This study demonstrated that player agility significantly moderates the effectiveness of small-sided games (SSG) and drill-based training on fundamental football skills in youth players. Significant method × agility interactions were observed for both passing–control and dribbling, indicating that the effectiveness of a training method depends on the learner's agility level rather than on the method alone. Drill-based training produced superior technical performance among high-agility players, whereas small-sided games were more effective for players with lower agility, particularly in improving dribbling performance. These findings support the ecological dynamics and constraints-led approach, suggesting that individual constraints play a critical role in determining the effectiveness of practice design. From a practical perspective, the findings advocate an individualised coaching approach in youth football. Rather than applying a single training method to all players, coaches should first assess agility and then select practice designs that best match each player's movement capabilities. Such an approach may improve technical skill acquisition while enhancing the efficiency of long-term player development programmes. Although the study provides novel evidence regarding the moderating role of agility, its findings should be interpreted in light of several limitations, including the relatively small sample drawn from a single academy and the exclusive inclusion of male youth players. Therefore, future studies should validate these findings using larger and more diverse samples, include female athletes and different competitive levels, and incorporate longitudinal designs together with biomechanical, physiological, and perceptual-cognitive measurements to further explain the mechanisms underlying person–method interactions in football skill acquisition.

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