Research on Talent Selection Criteria for High School Football Central Defenders based on a Multidimensional Evaluation System

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Abstract. This study is to set up a scientific evaluation system for choosing high school football central defenders. The Delphi method is used to judge 55 preliminary indicators by experts. After verification for consistency (Kendall's W = 0.638, $p < 0.05$) and comprehensive analysis, a three-dimensional evaluation framework was constructed with a percentage of physical fitness (37.10%), specialized technical skills (25.03%), and tactical awareness (37.87%) based on weights determined by the Analytic Hierarchy Process. It is advisable that tactical awareness and physical fitness are placed before technical skills. Innovatively, the present study adapted the traditional eleven-a-side match evaluations into 7-a-side small-field matches, which accord with the developmental characteristics of adolescents. Practical testing showed excellent discriminative validity (SD = 8.47) and criterion-related validity (correlation coefficient with coaches' evaluations: $r = 0.82$, $p < 0.01$), which findings should reveal the trend in modern football towards comprehensive defensive aptitudes and therefore are valuable for practical use in youth talent identification.

Keywords: Football central defender; Talent selection; Evaluation system; Delphi method; Tactical awareness.

1. Introduction

The development of new football strategies toward a total football concept has changed the central defender's function from just being a defensive player to become one of many roles within the central defensive organization, the game management as well as participation in the attack. As the deepest players among outfield players (excluding the goalkeeper), the back-center now coordinate not just the defense but also the maximization of counter-attacking strategies. However, their contribution, mostly allocated within middle and lower thirds, is hardly measured with goals and assists and is thus a challenge for the scouting process.

Present techniques in the choice of central defenders among youth footballers are mainly based on the subjective evaluations made by the coaches regarding the "positional awareness" and "defensive intelligence." This method is lacking for two main reasons: first, due to the non-availability of objective, quantifiable grounds, the method is more vulnerable to evaluator bias and, second, the limited scope of assessment does not cover the broad set of skills that today's central defenders need. Such systemic inadequacies run the risk of missing out on good defensive talents and, hence, undermining the quality of youth football development programs.

To solve these problems, this paper tries to set up a mathematical model for objective evaluation indices of high school central defenders. The research method is as follows:

- The initiation of indicators through literature analysis
- Expert refinement of criteria by Delphi
- Indicator weight determination by using Analytic Hierarchy Process (AHP)

Making creative modifications to standard evaluation measures for 11-a-side games, this study adjusts them to 7-a-side small-sided competitions, which are more in tune with the traits of teenage growth. The paper thus offers a structured, facts-founded model that can make selection procedures more objective and comprehensive in youth football programs.

2. Literature Review

2.1. Current Research on Youth Football Talent Selection

Scientific talent identification has gained popularity with the increasing global development of youth football. Tian et al., drawing from data gathered in top-tier European academies, highlighted the importance of systematic selection criteria in the success of youth development programs [3]. As per Liu, China chooses its youth football based on the experience of the coaches, and there is no standard evaluation system [4]. Unlike underdeveloped football nations, developed ones have already put multidimensional evaluation models into use. According to Wrang et al., structured selection systems increased the accuracy of talent identification by over 30% [5].

2.2. Evolution of Central Defender Selection Criteria

Conventional selection attributes gave prior rating to the physical appearance and defensive skills/nature, but an alteration of modern tactical demands has redesigned what duties a central defender executes. Data from a Premier League was collected and analyzed over the past ten years; it reflected a 47% improvement in passing and a further 35% rise in attacking play by the central defenders [6]. It further recommended to adopt a model of three parts, i.e., technical, tactical, and psychological, for the evaluation of youth center-backs, which belong to the directions set by FIFA for training youths in 2024; those directions emphasize a full-quality evaluation—especially on the tactical intelligence and the technical abilities of the player—as very important for the central defenders of today [7].

2.3. Methodological Advances in Football Talent Evaluation

Evaluation methodologies have increasingly become quantitative. The indicator weights are difficult to determine; therefore, a fuzzy comprehensive evaluation system was put up by Sałabun et al. to evaluate players, limiting its practicality [8]. Noor validated the Delphi method of developing metrics for selection [9]. Nisel and Özdemir have combined AHP with Delphi into a scientifically sound framework; this provides methodology information for the present study [10].

2.4. Research Gaps and Innovations

The three major problems with existing research are as follows: first, the lack of position-specific assessment systems; second, overcomplicated indicators that are not conducive to practical application; and third, studies done without the criteria localized to the situation of Chinese youth. To fill the gap, this study will innovate in the following ways: first, construct an evaluation system specifically for central defenders; second, research by means of qualitative and quantitative methods to increase objectivity; and third, adjust the practicality of the research results in terms of being applied to high school team recruitment.

3. Research Methodology

3.1. Research Framework

This study takes a quantitative research method to use the Delphi method and the Analytic Hierarchy Process for constructing the center-back selection evaluation system for high school soccer. The research is divided into three phases: (1) the pool of indicators is initiated by means of literature analysis; (2) the system of indicators is optimized by Delphi expert consultations; and (3) the determination of hierarchical indicator weights by AHP.

3.2. Indicator System Development

3.2.1 Initial Indicator Pool

The literature is based on research obtained from the CNKI database for the years 2019-2024 and from important documents like the Chinese Football Association Youth Training Guidelines, Testing Manual for Youth Football Players' Athletic Abilities, and Stage-Based Evaluation Standards for Chinese Male Youth Players' Athletic Performance. An evaluation system was developed with a basic framework consisting of three primary indicators, fourteen secondary indicators, and thirty-seven tertiary indicators. Due consideration was given in the selection criteria to ensure that they matched the principles of youth training and that there is a need for a center-back position, thus ensuring scientific validity and practical applicability.

3.2.2 Delphi Method Implementation

Expert Selection: Ten experts were purposively sampled if they achieved the following three conditions: (1) At least five years of football coaching experience; (2) At least ten years of professional football involvement; and (3) having experience coaching high school or collegiate teams. Experts ranged from former professional players to national and high school team coaches and university-level coaches from different regions in China, Brazil, and New Zealand.

Questionnaire Design: The Likert scale, graded 1="very unimportant" and 5="very important", was the instrument for expert ratings, with provision for open-ended comments.

Data Collection: Streamlined into one session of consultation, the study merged email questionnaires and face-to-face conversations (100% response rate). Expert reviews were examined by using the coefficient of variation (Cv), arithmetic mean, and full-score frequency. Indicators that called for some adjustment or removal met at least one of the three criteria: Cv >0.20, mean<3.0, or full-score frequency<20%.

3.3. Weight Determination

3.3.1 Analytic Hierarchy Process (AHP)

The weights were assigned by pairwise comparison using 9-point AHP scale (1="not important compared to" to 9="absolutely more important") with reciprocals to indicate inverse importance relationships. The same 10 experts involved in Delphi took part in this phase.

3.3.2 Weight Calculation

Key steps included: (1) synthesizing expert matrices by the geometric mean; (2) deriving weight vectors by means of arithmetic mean; (3) consistency validation (CR less than 0.1 required for acceptance).

The formulas are as follows: For weight values of each indicator, which are also the eigenvectors (ω_i) of the matrix:

$$\omega_i = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}}\right) \tag{1}$$

where ω_i represents the weight of the *i*-th indicator, and *n* represents the number of indicators at this level.

For Consistency Index (*CI*):

$$CI = \frac{\lambda_{max}-n}{n-1} \tag{2}$$

where λ_{max} is the maximum eigenvalue of the judgment matrix:

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\frac{(A\cdot\omega_i)}{\omega_i} \tag{3}$$

For Consistency Ratio (*CR*):

$$CR = \frac{CI}{RI} \quad (4)$$

where *RI* is random index, here, when n=3, RI=0.58.

4. Research Results and Analysis

4.1. Indicator Screening Results Analysis

The test of consistency of ratings made by experts produced a value of the coefficient of Kendall's W as 0.638 with an asymptotic significance of 0.000 (Table 1). It shows strong agreement among experts, which would allow the index system to be reliable.

Table 1. The consistency test of expert ratings.

Statistical Parameters	Values
Sample Size (N)	10
[a]Kendall's W	0.638
Chi-Square	344.613
Degrees of Freedom (df)	54
Asymptotic Significance	0.000

[a] Kendall's W represents the coefficient of concordance.

The first indicator system was modified in a planned manner based on expert reviews and suggestions. The main change at the level of primary indicators was replacing "Game Performance" with "Tactical Awareness," a major attribute that modern football has brought to the limelight regarding tactics. Currently, as football tactics advance, the center-backs are supposed to not only execute defensive duties but more significantly show high-level tactical understanding as well as decision-making abilities during the game.

At the next level of the index, the factors of 'Tackling Ability' and 'Sliding Tackle Ability' were combined into one. This unification makes the review system flow better because sliding tackles naturally show a part of the technique involved in tackling. Also, since the state of physical growth and the actual condition of training for high school athletes are taken into consideration, the test for an '11v11 Match' was modified to fit a '7v7 Match'. This change reduces excessive physical strain while also making the observational setting more direct and useful. The final, agreed choice criteria are given in Table 2.

Table 2. The determined selection and evaluation indicators.

PRIMARY INDICATOR	SECONDARY INDICATOR	TERTIARY INDICATOR
A1 PHYSICAL FITNESS	B1 Strength	C1 Bench Press
		C2 Dead-lift
	B2 Explosive Strength	C3 Vertical Jump
		C4 30m Sprint
	B3 Stamina	C5 YO-YO Test
	B4 Agility	C6 Illinois Agility Test
A2 SPECIALIZED SKILLS	B5 Interception Ability	C7 Predict Ground Ball Trajectory and Intercept
		C8 Predict High Ball Landing Point and Intercept
		C9 Player Interception Skill
	B6 Header Techniques	C10 Header Clearing
		C11 Shoot-on-Sight Header
	B7 Tackling Skills	C12 1v1 Defending
		C13 Block Tackle
		C14 Poke Tackle
		C15 Shoulder Push Tackle
		C16 Side-Chase Sliding Tackle
		C17 Front Anticipation Sliding Tackle
	B8 Passing Accuracy	C18 Accurate Short Pass
		C19 Accurate Cross Long Pass
	B9 Ball Control Ability	C20 Back and Forth Dribbling
		C21 Around Stick Dribbling
	B10 Ball Receiving Ability	C22 Ground Ball Receiving
		C23 High Ball Receiving
		C24 Ball Receiving Using Chest
		C25 Ball Receiving Using Head
A3 TACTICAL AWARENESS	B11 7vs7 Matches	C26 Positioning Awareness
		C27 Covering Awareness
		C28 Defensive Coordination Awareness
		C29 Positioning Sense
		C30 Fearlessness
		C31 Jockeying
		C32 Communication

4.2. Indicator Weight Analysis

4.2.1 Primary Indicator Weight Distribution

The AHP calculation gave three main indicators with weights as shown in Table 3. Tactical Awareness and Physical Fitness showed similar weighting, much greater than Specialized Techniques. This distribution mirrors modern selection criteria which focus on broad abilities rather than special skills. Noteworthy, raising tactical awareness to the level of parity with physical fitness is a paradigm change from the old, body-centric choice standards.

Table 3. Selection Indicators and Their Weights.

PRIMARY INDICATOR	SECONDARY INDICATOR	TERTIARY INDICATOR
A1 PHYSICAL FITNESS (37.10%)	B1 Strength (9.21%)	C1 Bench Press (6.35%)
		C2 Dead-lift (2.86%)
	B2 Explosive Strength (8.27%)	C3 Vertical Jump (4.72%)
		C4 30m Sprint (3.55%)
	B3 Stamina (10.58%)	C5 YO-YO Test (10.58%)
	B4 Agility (9.04%)	C6 Illinois Agility Test (9.04%)
A2 SPECIALIZED SKILLS (25.03%)	B5 Interception Ability (7.60%)	C7 Predict Ground Ball Trajectory and Intercept (2.93%)
		C8 Predict High Ball Landing Point and Intercept (1.62%)
		C9 Player Interception Skill (3.04%)
	B6 Header Techniques (2.48%)	C10 Header Clearing (1.88%)
		C11 Shoot-on-Sight Header (0.60%)
	B7 Tackling Skills (3.17%)	C12 1v1 Defending (0.86%)
		C13 Block Tackle (0.49%)
		C14 Poke Tackle (0.43%)
		C15 Shoulder Push Tackle (0.88%)
		C16 Side-Chase Sliding Tackle (0.32%)
		C17 Front Anticipation Sliding Tackle (0.17%)
	B8 Passing Accuracy (4.26%)	C18 Accurate Short Pass (3.19%)
		C19 Accurate Cross Long Pass (1.07%)
	B9 Ball Control Ability (5.09%)	C20 Back and Forth Dribbling (2.64%)
		C21 Around Stick Dribbling (2.45%)
	B10 Ball Receiving Ability (2.43%)	C22 Ground Ball Receiving (1.08%)
		C23 High Ball Receiving (0.81%)
		C24 Ball Receiving Using Chest (0.32%)
		C25 Ball Receiving Using Head (0.22%)
A3 TACTICAL AWARENESS (37.87%)	B11 7vs7 Matches (37.87%)	C26 Positioning Awareness (6.54%)
		C27 Covering Awareness (4.13%)
		C28 Defensive Coordination Awareness (4.24%)
		C29 Positioning Sense (3.68%)

	C30 Fearlessness (4.42%)
	C31 Jockeying (8.58%)
	C32 Communication (6.27%)

4.2.2 Secondary Indicator Weight Characteristics

In the Physical Fitness dimension, the indicator for endurance showed the highest weighting at 10.58 percent, followed by strength at 9.21 percent and agility at 9.04 percent (Table 3). Endurance is, therefore, most important because it shows that the player must be able to keep high-intensity concentration and physical readiness throughout the match in modern football. The near level of weighting between strength and agility shows the need for the development of balanced physical oppositional skills and quick responsive skills.

In the dimension of Specialized Techniques, among the technical indicators, the ability of interception has a significant percentage of 7.60, greater than others considerably well, which is related to the central defenders' core defensive tasks. The factor ball control achieved relatively high weighting 5.09, which indicates the modern demand on defenders to have offensive organization ability. Although passing accuracy has obtained less weighting 4.26, its value is very important strategically in quick transitions from defense to offense.

4.2.3 Tertiary Indicator Analysis

Of the newly added metrics in strength assessment, Bench Press demonstrated a higher percentage of weighting at 6.35%, as opposed to Deadlift, which was at 2.86%. This variance indicates the more important contribution of Bench Press to the physical duels and aerial challenges because, though less weighted, Deadlift complements the former by being an upper-body strength indicator.

In the 7v7 match assessment framework, the attainment of Jockeying had the greatest weighting at 8.58%, followed by Positional Awareness at 6.54%, and Communication Ability at 6.27%, as indicated in Table 3. This distribution draws attention to the increasing value placed on defensive organization and, more especially, team coordination in holding up opposition attacks and the defensive support required.

4.2.4 Weight Calculation Reliability

Consistency tests at all levels of indicators yielded CR values less than 0.1 (see Table 4 and 5), with primary indicators attaining CR=0.00005, secondary indicators varying between 0.005 to 0.039, and tertiary indicators between 0.003 to 0.036. These results indicate that in the expert ratings there is strong logical consistency, which ensures the internal coherence and practical applicability of the evaluation system.

Table 4. Consistency Test Results for Secondary Indicators of A2 (Specialized Skills).

Parameters	Values
Maximum Eigenvalue (λmax)	6.245
Consistency Index (CI)	0.049
Random Index (RI)	1.260
Consistency Ratio (CR)	0.039
Test Result	Pass

Note: The consistency is considered acceptable when CR < 0.1.

Table 5. Summary of Consistency Test Results for Tertiary Indicators.

Indicator	λmax	CI	RI	CR	Result
B1: Strength	2.000	0.000	0.000	-	Pass
B2: Explosive Strength	2.000	0.000	0.000	-	Pass
B5: Interception Ability	3.003	0.002	0.520	0.003	Pass
B6: Header Techniques	2.000	0.000	0.000	-	Pass
B7: Tackling Skills	6.196	0.039	1.260	0.031	Pass
B8: Passing Accuracy	2.000	0.000	0.000	-	Pass
B9: Ball Control Ability	2.000	0.000	0.000	-	Pass
B10: Ball Receiving Ability	4.051	0.017	0.890	0.019	Pass
B11: 7v7 Matches	7.291	0.049	1.360	0.036	Pass

4.2.5 Interweight Structural Relationships

Analysis revealed there were interactive relationships among the primary indicators. The near-equivalent weighting of Physical Fitness and Tactical Awareness reflects what is a very synergistic operational relationship between them: superior physical conditioning probably allows for good tactical execution, while at the same time, enhanced tactical awareness optimizes the allocation of physical resources. Though relatively lower-weighted, it is noted that Specialized Techniques cannot be attained without the satisfactory development of the abovementioned factors.

Additional scrutiny unveiled multilateral relationships in high-weight sub-indicators. For example, stamina (10.58%) has a direct influence on the defending quality and at the same time affects the stability of tactics. Also, intercepting passes (7.60%) depends both on accurate passing and on the anticipation in tactics. Such dependencies call for a consideration of the comprehensive outcome during the choice of a player.

4.3. Practical Application Value

The results of this procedure were applied in a conversion to a 100-point scoring system with age-graded benchmarks. Physical assessments use standardized metrics — sprint test, standing broad jump — while technical assessments combine quantitative measures — passing-accuracy exercise — and qualitative evaluation by the coach on the play of the player. Tactical awareness is assessed by means of 7v7 games that bring into consideration spatial perception, defensive anticipation, and decision-making.

A pilot test with 15 high school center-backs showed strong discriminatory power (SD=8.47) and significant coach evaluation correlation ($r=0.82$, $p<0.01$), thus providing evidence for the validity of the system.

4.4. System Optimization Recommendations

Areas for adjustment were found in the following aspects:

• The gradients in difficulty of technical tests should be adjusted so that different levels of skills can perform well in them.

• A more detailed scoring rubric should be prepared for the observation of 7v7 to increase the objectivity of the criteria.

• The two levels of scoring criteria (basic/advanced) may be able to solve the problem of the difference in regional development.

High correlations between tertiary indicators (e.g. T-test and Z-test agility assessments, $r=0.91$) indicate potential for streamlining redundant metrics. When bright tracking tools are brought in, they can give solid information on knowledge of tactics by an individual through analysis of movement patterns.

5. Discussion

This study creates a center-back player selection evaluation system in high school, giving new requirements for the identification of talent in modern soccer and provoking consideration into the methodologies of youth player selection.

The study obtained that tactical awareness and physical fitness hold almost equivalent maximum weights in the evaluation system 37.87% and 37.10% respectively signaling a major shift in the role center-backs play. In fast-paced games with increasingly complicated tactic forms, modern center-backs have changed from being mere central defenders to being comprehensive organizers. However, subjectivity is at a high level when it comes to the assessment of tactical awareness compared to the measurement of physical and technical competence. The study used 7-a-side small-sided games to ensure a focused observation setting but still faces the precise quantification of tactical awareness. This evaluation challenge resounds with the current academic debate on standardizing tactical assessment and testing cognitive abilities among youth players.

The change from normal 11-a-side to 7-a-side game assessment is an alteration reflecting the physical and psychological attributes of high school students, on whom such tests are applied. The change makes things easier to do but, better yet, it makes the watching conditions just right. Small games mean more touching of the ball and show its skill and strategy side. But if this test way really tells how well players will do in a regular 11-a-side game, long-term follow-up studies have to be done to check this, especially in the area of Chinese young soccer player development, where making practice work as well as being ready to play is still a main research topic.

The intricate interrelationships between the indicators brought out by this study to the fore the fact that they should be viewed holistically. In other words, in the above example, physical fitness directly affects the stability of tactical implementation, and the ability of a player to technically perform well affects the realization of tactics. Such complex correlations revealed by the study imply that, in practice, talent identification should be based on the priority of synergistic effects between several indicators rather than the all-out development of Single skills. This sheds important insight into correcting the prevalent selection biases that placed too much emphasis on technical skills over tactical cognition or physical attributes over strategic awareness.

Even though the proposed test showed good results in early trials, its future success needs to be checked over time. The main problem is to see if these test results now can predict well how a player will develop, which includes looking at how realistic the test situation is and basic questions about finding talent in youth soccer. In the Chinese soccer training setup, applying these smart test ways together with normal thinking needs more hands-on work.

This study has some significant limitations. First, the evaluation framework, as developed in this study, is more of a reflection of the Chinese youth soccer development system; hence, it requires validation in other cultural settings. Second, some of the ways indicators are measured need fine-tuning and standardization, especially in the aspect of tacit understanding counting. Last, but not least, the predictive validity of the system demands support through extended research involving tracking, which more or less is an emphatic idea for further studies.

6. Conclusion

This study developed a talent selection evaluation system for high school central defenders, revealing new demands modern football requires from this position. According to the results obtained, essential central defender selection should transcend traditional single-dimensional assessment based on technical or physical attributes, to set a multidimensional evaluation framework. The three-dimensional indicator system built to appraise central defenders adequately reflects the core requirements of the position and serves as a reliable scientific framework for talent identification.

Noticing this, smart knowledge has come up as a key point in choosing players, showing a big change in what is needed from modern central defenders. New players in this position don’t just do defense work but need to show better tactical understanding and good choices. This finding questions

old ways of picking people, needing more focus on looking at players' thinking skills and game smarts during selections.

The creative use of 7-a-side small-field games as an assessment tool for high school players shows special benefits. This method considers the body and mind growth of young people while making a good setting for a full review of tech-skills knowledge. Also, the study found big linked ideas among assessment marks, stressing the need for a whole view during picking actions rather than separate checks on one skill.

This study has, from both scientifically and operationally standpoints, practical value in its evaluation system for the selection of central defenders. The future direction it should take is to validate the predictive efficacy of the system through longitudinal player tracking, measurement standards for individual indicators need refining, and differentiated assessment protocols should be worked out for different skills of the players. Also, a cultural adaptability adjustment of the evaluation framework needs further exploration. These would go a long way in improving youth football talent identification systems, scientifically informing the cultivation of Chinese football reserves.

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