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Early-stage study on the urgency of a sport climbing performance assessment model based on LTAD framework for talent identification

Liska Sukiyandari[1], Heny Setyawati[2*], Tandiyo Rahayu[3], Sulaiman[4], Ariyatun[5]
[1,2,3,4]Doctoral of Physical Education Department, Universitas Negeri Semarang, Indonesia;
liskasukiandari@students.unnes.ac.id (L.S.) henysetyawati@mail.unnes.ac.id (H.S.) tandiyorahayu@mail.unnes.ac.id (T.R.)
sulaiman@mail.unnes.ac.id (S.)
[5]Department of Chemistry Education, Universitas Negeri Jakarta, Indonesia; ariyatun@unj.ac.id (A.).

Abstract: This study aims to examine the urgency of developing a Sport Climbing Performance Assessment (SCPA) model based on the Long-Term Athlete Development (LTAD) framework for talent identification. A quantitative descriptive approach was employed, with data collected through a structured questionnaire distributed to 22 respondents, including head coaches, assistant coaches/administrators, and sports science experts. The analysis involved descriptive statistics, Shapiro-Wilk normality tests, reliability testing, and One-Way ANOVA to explore differences in perception among participant groups. The results indicated a strong consensus among respondents on the need for a structured and LTAD-oriented performance assessment model for sport climbing. Overall, participants showed high levels of agreement on the urgency of establishing a more systematic and long-term development framework. While most group comparisons revealed no significant perceptual differences, one area showed head coaches expressing notably stronger expectations for model development than other groups. In conclusion, there is a broadly shared recognition of the need to reform current athlete selection methods by incorporating objective and developmentally appropriate performance assessments. The study supports the foundation for constructing a more adaptive, standardized, and scientifically grounded SCPA model. From a practical standpoint, these findings highlight the importance for sport governing bodies to implement long-term, inclusive assessment systems that align with diverse coaching perspectives and promote consistent athlete development.

Keywords: *LTAD, Performance assessment, Rock climbing, SCPA, Talent coaching.*

1. Introduction

One of the fast-growing sports that has attracted attention, especially after its inclusion in the Olympics, rock climbing even in Indonesia, the popularity of this sport is increasing rapidly and has gained support from various competitions held at the regional and national levels, including the one for early age groups [1, 2]. Yet despite those advances, the identification and coaching of elite athletes is still fraught with problems [3]. In reality, athlete selection has a big dependence on the results of the competition, the number of speed climbs in particular, without a structured and comprehensive performance assessment guide [4]. One such approach for effective athlete development is the LTAD model. This model highlights the need for age and stage-appropriate training and a gradual and holistic approach to performance, incorporating all aspects: physical, technical/tactical, and psychological [5]. The LTAD has been applied across a range of sports, including but not limited to swimming, gymnastics, and athletics, where it has been found to support the talent identification process, ranging from early age talent identification to peak performance attainment [6, 7]. However, the application of this concept to rock climbing in Indonesia is still very limited.

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* Correspondence: henysetyawati@mail.unnes.ac.id

Based on preliminary observations made during the athlete selection process in the FPTI Regency of Central Java, there is no formal and comprehensive performance assessment model. The final results of the competition, combined with subjective assessments, are the usual basis of decision-making by coaching and selection teams. First is the unfortunate and dangerous practice of dismissing young athletes who already has talent, yet inexperience, puberty or effort leave her behind her peers. So, a LTAD-based model of assessment is required, which can serve as an objective and long-term oriented guide to the talent guidance process [8, 9].

Several previous publications have suggested that structured performance testing should be integrated into the talent identification process in sport [10, 11]. While previous literature relating to rock climbing has largely concentrated on the physiological elements of the athlete [11] and motor abilities [12] little has been done in constructing individualized and specific testing models based on the needs of the sport, particularly those catered to the development of early-stage and adolescent athletes [13, 14]. This indicates that the research gap is still wide open to explore. Alongside the results of field observations, the distribution of questionnaires to coaches, rock climbing club administrators, and sports experts showed similar results in preliminary studies. The current way of assessing performance has not been able to identify talent in a comprehensive and unbiased manner, as most respondents answered. They also stressed the need to establish a performance evaluation model that is compliant with LTAD principles, so that the selection and training process of athletes does not rely solely on competitive results.

Recent studies further support the integration of structured, sport-specific assessment models to improve the accuracy of talent identification and the efficiency of athlete development. Performance indicators tailored to the physiological and psychological demands of specific sports can significantly enhance long-term athlete tracking and reduce drop-out rates during adolescence [15, 16]. Assessment protocols that align with LTAD in new sports, contribute to a fairer selection process and encourage continuity of development [17]. In the context of climbing, the individualized performance assessments accounting for climbing style, technical complexity, and cognitive adaptability are crucial to developing high-potential athletes from an early age [18]. These findings reinforce the relevance of designing a climbing-specific assessment framework that reflects the multifaceted nature of athlete performance and aligns with LTAD stages.

In response to this background, the present study aims to investigate the urgency and basic elements in the process for the construction of a Sport Climbing Performance Assessment (SCPA) based on the LTAD framework. The empirical initial contribution in this research is expected to build a more systematic, relevant, and applicable performance assessment model to support talent guidance and long-term development of rock climbing athletes, especially in Indonesia.

2. Materials and Methods

2.1. Research Design

This study uses a descriptive quantitative approach with a survey method, with questionnaires to examine the initial perception and urgency of developing an SCPA model based on the LTAD framework [19]. This design was chosen because it is suitable to obtain an overview of the needs and views of stakeholders in the process of selecting and guiding the talents of rock climbing athletes. The purpose of this design is to objectively describe the phenomena that occur in the field based on the data obtained from the questionnaire instruments.

2.2. Research Participants

This research was carried out at the Regency Management of the Federasi Panjat Tebing Indonesia (FPTI), Central Java, Indonesia. A total of 22 respondents participated in this study, which was selected by purposive sampling based on their active involvement in the coaching and management activities of rock climbing athletes. Respondents consisted of 8 main rock climbing coaches, 7 assistant coaches and club administrators, and 7 lecturers or experts in the field of sports and sports coaching. All participants

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have first-hand experience in the process of coaching athletes, talent selection, and have a good understanding of the challenges in developing athlete performance from an early age. The characteristics of the participants in the study are presented in Table 1.

Table 1.
The Characteristics of the Participants.

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Gender				
Female	9	40.909	40.909	40.909
Male	13	59.091	59.091	100.000
Education				
Bachelor	5	22.727	22.727	22.727
Magister	7	36.364	36.364	59.091
Doctor	8	31.818	31.818	90.909
Professor	2	9.091	9.091	100.000
Coaching certification				
Yes	18	81.818	81.818	81.818
No	4	18.182	18.182	100.000
Role/Position				
Coach	8	36.364	36.364	36.364
Assistant coach	7	31.818	31.818	63.636
academics	7	31.818	31.818	100.000
Total	22	100.000	100.000	100.000

The distribution of participants in this study shows a balanced representation of various relevant backgrounds in the context of the development of rock climbing athletes. In terms of gender, the majority of respondents were male (59.1%), reflecting the general composition in the world of sports coaching, although the participation of women (40.9%) was also quite significant. In terms of education, participants had a high level of education, where most of them had master's degrees (36.4%) and doctorates (31.8%), and even two professors (9.1%). This shows that respondents have strong intellectual and academic capacity in understanding and evaluating sports performance assessment models. In addition, the majority of participants (81.8%) already have an official coaching certification, signifying that they are not only practically active but also have professional recognition in the field of coaching. The roles or positions of participants also vary, consisting of main coaches (36.4%), assistant coaches/club administrators (31.8%), and lecturers or academics in the field of sports science (31.8%). This diversity of backgrounds provides depth and breadth of perspective in their assessment of the urgency of developing LTAD-based performance assessment models, as well as increasing the validity of the research findings as they reflect views from various sides in the rock climbing athlete coaching ecosystem.

2.3. Research Instruments

Data collection was carried out using a structured questionnaire which was prepared based on the principles of sports performance assessment and the LTAD framework. This instrument was developed through theoretical studies and discussions with sports science experts to ensure the relevance and clarity of the question items. The questionnaire consists of 20 statement items grouped into four main dimensions, namely: Need for structured performance indicators, Limitations on current talent selection practices, Support for the integration of LTAD-based assessments, and Expectations for future forms of SCPA model. Each item is rated using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The results of the descriptive analysis of the questionnaire are presented in Table 2.

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Table 2.
Descriptive Statistics Questionnaire

	Valid	Missing	Mean	Std. Deviation	Variance	Shapiro-Wilk	P-value of Shapiro-Wilk	Minimum	Maximum
Q1	22	0	4.227	0.685	0.470	0.794	0.071	3.000	5.000
Q2	22	0	3.818	0.733	0.537	0.804	0.104	3.000	5.000
Q3	22	0	4.227	0.752	0.565	0.796	0.091	3.000	5.000
Q4	22	0	3.909	0.811	0.658	0.859	0.114	2.000	5.000
Q5	22	0	3.909	0.811	0.658	0.859	0.081	2.000	5.000
Q6	22	0	4.091	0.610	0.372	0.770	0.104	3.000	5.000
Q7	22	0	4.000	0.816	0.667	0.847	0.183	2.000	5.000
Q8	22	0	4.091	0.684	0.468	0.804	0.104	3.000	5.000
Q9	22	0	4.091	0.811	0.658	0.803	0.081	3.000	5.000
Q10	22	0	4.091	0.811	0.658	0.803	0.104	3.000	5.000
Q11	22	0	4.364	0.492	0.242	0.613	0.066	4.000	5.000
Q12	22	0	3.955	0.899	0.807	0.835	0.004	2.000	5.000
Q13	22	0	3.636	1.002	1.004	0.859	0.071	2.000	5.000
Q14	22	0	4.045	0.653	0.426	0.793	0.094	3.000	5.000
Q15	22	0	4.045	0.722	0.522	0.813	0.081	3.000	5.000
Q16	22	0	4.045	0.722	0.522	0.775	0.094	2.000	5.000
Q17	22	0	4.136	0.774	0.600	0.799	0.074	2.000	5.000
Q18	22	0	4.045	0.785	0.617	0.825	0.112	2.000	5.000
Q19	22	0	3.955	0.899	0.807	0.835	0.093	2.000	5.000
Q20	22	0	4.045	0.785	0.617	0.825	0.1042	2.000	5.000

In general, the respondents have a positive perception of the need for LTAD-based performance assessment in the context of sports coaching. The average item score ranges from 3,636 to 4,364, which indicates a fairly high level of approval of the statements in the questionnaire. Item Q11 had the highest average score (M = 4.364) with the lowest standard deviation (SD = 0.492), reflecting a strong consensus among respondents. In contrast, item Q13 showed the lowest average (M = 3.636) and the highest standard deviation (SD = 1.002), signaling greater variation in responses. The Shapiro-Wilk normality test showed that most of the data were normally distributed ($p > 0.05$), so these results support the feasibility of further analysis with a parametric approach. These findings confirm the urgent need for the development of a systematic, adaptive, and LTAD-based performance assessment model. Reliability tests were also performed using Cronbach's Alpha, which yielded a value of 0.93, indicating that this questionnaire had excellent internal consistency, which is presented in Table 3.

Table 3.
Frequentist Scale Reliability Statistics.

Estimate	Cronbach's α	S.D.
Point estimate	0.930	10.077
95% CI lower bound	0.872	7.753
95% CI upper bound	0.965	14.400

Note: Variables Q18 and Q20 correlated perfectly.

Cronbach's Alpha value of 0.93 indicates that the questionnaire has very high reliability, with strong internal consistency between items [20]. This indicates that all statements in the questionnaire consistently measure the same construct, although there is a perfect correlation between items Q18 and Q20 that needs further attention.

2.4. Data Collection Procedure

The data collection was carried out from February to March 2025, coinciding with the athlete selection process organized by the FPTI Regency of Central Java. Questionnaires are given to participants directly in printed form during the selection activity, or online through a digital form that

is sent personally. Before filling out the questionnaire, all respondents were given an explanation of the purpose of the research and were asked to give voluntary informed consent.

2.5. Data Analysis Techniques

The data obtained from the questionnaire was analyzed using descriptive quantitative the help of JASP software. The analysis was carried out to find out the average score (mean), standard deviation, and percentage distribution of respondents' answers in each dimension. The results of this analysis are used to illustrate the extent to which coaches and stakeholders feel the need for a more systematic performance assessment model that is in line with the principles of long-term athlete development. In addition, it was followed by a One-Way ANOVA test, which aimed to analyze significant differences in perceptions of the urgency of the LTAD-based SCPA model between the main coaching group, assistant coaches/administrators, and lecturers/sports science experts.

Furthermore, the One-Way ANOVA test was carried out to analyze the difference in perception between the three groups of participants [21] namely the main coach, assistant coach/club administrator, and lecturer or expert in the field of sport science. The normality assumptions were tested using the Shapiro-Wilk test, and the homogeneity of variance with Levene's Test, before the analysis was performed [22]. Both prerequisite tests indicated that the data met normality and homogeneity assumptions ($p > 0.05$) and could therefore be continued with a one-way ANOVA test.

3. Results

3.1. Overview of the Need for a Performance Assessment Model Based on Descriptive Statistics

The results of this research in this section are the average score (mean), standard deviation, and the percentage distribution of respondents' answers in each dimension of the questionnaire. The primary purpose is to ascertain how pervasive the perceived urgency is among trainers and stakeholders, and whether how to develop a systematic performance assessment is more suitable for LTAD connotes principles. The complete statistical descriptive results on each dimension of need are presented in Table 4.

Table 4.
Descriptive Statistics Questionnaire on each dimension of needs.

Indicators	Mean	Std. Deviation	Variance	Shapiro-Wilk	P-value of Shapiro-Wilk
Limitations of Current Talent Selection Practices	18.091	2.580	6.658	0.892	0.071
Support for LTAD-Based Assessment Integration	20.000	3.677	13.524	0.889	0.068
Expectations for the Future Form of the SCPA Model	19.909	2.706	7.325	0.929	0.084
The Need for Structured Performance Indicators	20.909	3.504	12.277	0.888	0.077

The results of the descriptive analysis showed that in general, respondents had a high level of agreement on the importance of developing a more structured and principle-based performance assessment model. The Need for Structured Performance Indicators dimension obtained the highest average score of 20.909 with a standard deviation of 3.504, indicating that the need for systematic performance indicators is felt most urgently by coaches and stakeholders. Meanwhile, the Support for LTAD-Based Assessment Integration dimension averaged 20,000 and showed the highest variation (variance = 13.524), reflecting the diversity of respondents' views on readiness or support for LTAD assessment integration. Other dimensions such as the Expectations for the Future Form of the SCPA Model and the Limitations of Current Talent Selection Practices also obtained high average scores, 19.909 and 18.091, respectively, which reinforced the finding that collectively, there is a strong perception of the need to reformulate performance assessment systems in the context of long-term coaching of athletes. The p-value on the Shapiro-Wilk test for all four dimensions > 0.05, which indicates that the data is normally distributed and worthy of further analysis with parametric tests. These results are reinforced by data from each questionnaire item, which is presented in Table 5.

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Table 5.
Frequentist Individual Item Reliability Statistics.

	If item dropped			
Item	**Cronbach's α**	**Item-rest correlation**	**mean**	**SD**
Q1	0.926	0.601	4.227	0.685
Q2	0.925	0.663	3.818	0.733
Q3	0.925	0.659	4.227	0.752
Q4	0.928	0.516	3.909	0.811
Q5	0.923	0.762	3.909	0.811
Q6	0.926	0.652	4.091	0.610
Q7	0.924	0.701	4.000	0.816
Q8	0.922	0.857	4.091	0.684
Q9	0.925	0.671	4.091	0.811
Q10	0.925	0.671	4.091	0.811
Q11	0.927	0.615	4.364	0.492
Q12	0.924	0.690	3.955	0.899
Q13	0.938	0.128	3.636	1.002
Q14	0.932	0.238	4.045	0.653
Q15	0.926	0.591	4.045	0.722
Q16	0.931	0.359	4.045	0.722
Q17	0.927	0.544	4.136	0.774
Q18	0.921	0.861	4.045	0.785
Q19	0.923	0.738	3.955	0.899
Q20	0.921	0.861	4.045	0.785

Table 5 describes the analysis of the reliability of each item, showing that most of the statements in the questionnaire have good internal consistency, indicated by a fairly high item-rest correlation value and a relatively stable Cronbach's α value if one item is deleted. Items Q8 and Q18 stand out with the highest correlation to the total scale (0.857 and 0.861), which indicates that these two items have a very strong contribution to the overall consistency of the questionnaire. The average scores for these two items were also high (4,091 and 4,045 respectively), and were supported by low standard deviations, indicating a high level of agreement and relatively homogeneous among respondents. In contrast, items Q13 and Q14 showed a low item-rest correlation (0.128 and 0.238, respectively), which means their contribution to overall reliability is relatively weak. This is reinforced by Cronbach's α value, which increases significantly if the item is removed (up to 0.938 in Q13). These findings indicate that the item may not be conceptually aligned with the construct being measured, or it may be interpreted differently by respondents. However, the mean value of almost all items was above 4, which strengthened the tendency of respondents to express approval of the need to develop a more systematic performance assessment model and by LTAD principles.

3.2. Differences in Perceptions Between Participant Groups on the Urgency of the LTAD-Based SCPA Model

These results were focused on the results of the One-Way ANOVA test to see if there was a significant difference in perception between the three groups of participants (main coach, assistant coach/administrator, and lecturer/sports science expert). The One-Way ANOVA test was conducted to determine whether there was a significant difference in the perception of the urgency of developing an LTAD-based SCPA model among three groups of participants, namely: head coaches, assistant coaches/club administrators, and lecturers or sports science experts. And before the ANOVA test is carried out, a prerequisite test is first carried out, namely: The data distribution normality test uses Shapiro-Wilk, which shows that the data is normally distributed ($p > 0.05$) on all dimensions, and the variance homogeneity test uses Levene's Test, which also shows that the variance between groups is homogeneous ($p > 0.05$).

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3.2.1. Limitations of Current Talent Selection Practices

In the dimension of Limitations of Current Talent Selection Practices, an ANOVA test was conducted to find out whether the three groups of participants had significantly different perceptions of the limitations of existing talent selection practices. The results of the analysis are presented in Table 6 and Table 7.

Table 6.
ANOVA - Limitations of Current Talent Selection Practices.

Cases	Sum of Squares	df	Mean Square	F	p
Role/Position	4.890	2	2.445	0.344	0.713
Residuals	134.929	19	7.102		

Note: Type III Sum of Squares.

Table 7.
Descriptive - Limitations of Current Talent Selection Practices.

Role/Position	N	Mean	SD	SE	Coefficient of variation
Academics	7	18.571	2.299	0.869	0.124
Assistant coach	7	17.429	3.552	1.343	0.204
Coach	8	18.250	1.982	0.701	0.109

The results of the One-Way ANOVA test on the dimension of Limitations of Current Talent Selection Practices were obtained with a value of F = 0.344 with p = 0.713 (Table 6). A p-value greater than 0.05 indicates that there is no significant difference between the three groups of participants (lead coach, assistant coach/administrator, and lecturer/sport science expert) in assessing the limitations of current talent selection practices. This indicates that perceptions of the weaknesses of the existing talent selection system are uniform across groups. The descriptive results in Table 7 reinforce these findings, where the average scores are in relatively close ranges: academics (M = 18,571, SD = 2,299), assistant coaches (M = 17,429, SD = 3,552), and head coaches (M = 18,250, SD = 1,982). The coefficient of variation also showed a fairly low rate of data dissemination, especially in the main trainer group (CV = 0.109), which indicates consistency of views within the group. Thus, it can be concluded that the entire group has a relatively aligned view of the need for improvement in current talent selection practices.

3.2.2. Support for LTAD-Based Assessment Integration

In the Support for LTAD-Based Assessment Integration dimension, the One-Way ANOVA test was conducted to evaluate whether there was a significant difference in perceptions between groups of participants regarding support for the integration of Long-Term Athlete Development (LTAD)-based assessments. The results of the statistical analysis are presented in Table 8 and Table 9.

Table 8.
ANOVA - Support for LTAD-Based Assessment Integration.

Cases	Sum of Squares	df	Mean Square	F	p
Role/Position	38.982	2	19.491	1.511	0.246
Residuals	245.018	19	12.896		

Note: Type III Sum of Squares.

Table 9.
Descriptive - Support for LTAD-Based Assessment Integration.

Role/Position	N	Mean	SD	SE	Coefficient of variation
Academics	7	19.714	2.928	1.107	0.149
Assistant coach	7	18.429	4.826	1.824	0.262
Coach	8	21.625	2.774	0.981	0.128

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The ANOVA results shown in Table 8 show that the value of F = 1.511 with a significance value of p = 0.246, which means that there is no statistically significant difference between the groups of participants in terms of support for the integration of LTAD-based assessments (because p > 0.05). These results show that in general, all groups have a relatively consistent level of perception regarding the importance of structured and long-term oriented assessments for athlete development.

However, when viewed from the descriptive data in Table 9, it appears that the main coaching group has the highest average score (mean = 21,625) compared to academics (mean = 19,714) and assistant coaches (mean = 18,429). This reflects that head coaches may practically feel more urgency for an assessment model that is integrated with LTAD principles, perhaps because they are closer to the reality of coaching athletes on the field. Nonetheless, the difference is not strong enough to produce statistical significance. In terms of coefficient of variation, the group of assistant trainers showed the greatest perceptual variability (CV = 0.262), indicating that there was a diversity of understanding or support for LTAD-based assessments within this group. In contrast, the main trainers and academics showed higher perceptual consistency, as indicated by lower CV scores (0.128 and 0.149, respectively). Overall, these results reinforce previous findings that, despite differences in role backgrounds, all groups view the integration of LTAD-based assessments as important for the future of athlete development, although differences in perceived intensity between groups are still within reasonable limits.

3.2.3. Expectations for the Future Form of the SCPA Model

This dimension is important because it reflects the extent to which stakeholders have an aligned vision regarding the direction of developing adaptive coach performance assessments and the long-term needs of athletes. This dimension also reflects how far stakeholders, such as head coaches, assistant coaches, and academics, have aligned their vision regarding the development of coach performance assessments that are adaptive and appropriate to the long-term needs of athletes. The results of the analysis are shown in Table 10 and Table 11.

Table 10.
ANOVA - Expectations for the Future Form of the SCPA Model.

Cases	Sum of Squares	df	Mean Square	F	p
Role/Position	45.657	2	22.829	4.010	0.035
Residuals	108.161	19	5.693		

Note: Type III Sum of Squares.

Table 11.
Descriptive - Expectations for the Future Form of the SCPA Model.

Role/Position	N	Mean	SD	SE	Coefficient of variation
Academics	7	19.714	1.704	0.644	0.086
Assistant coach	7	18.143	3.024	1.143	0.167
Coach	8	21.625	2.264	0.800	0.105

The results of the ANOVA test presented in Table 10 showed a value of F = 4.010 with p = 0.035, which means that there was a significant difference between the groups of participants in terms of expectations for the future form of the SCPA model (p < 0.05). Thus, these results suggest that perceptions regarding future forms of SCPA models differ significantly between lead coaches, assistant coaches, and academics. Next, Table 11 displays the descriptive results for each group of participants. The main coaching group showed the highest average (mean = 21,625) compared to the academic (mean = 19,714) and assistant coach (mean = 18,143) groups. This suggests that head coaches have higher expectations of the future shape of the SCPA model, indicating that they prefer a model that is more comprehensive and in line with the development and needs of athletes in the long term [23].

In addition, the standard deviation (SD) and standard error (SE) values also showed differences in perception variation between groups. The academic group had a smaller standard deviation (SD =

1.704) and a lower coefficient of variation (CV = 0.086), which indicated a higher degree of uniformity in their perceptions. Meanwhile, the assistant coach group had the largest standard deviation (SD = 3.024) and a higher coefficient of variation (CV = 0.167), suggesting there was more difference in their perception of the future shape of the SCPA model. These results suggest that although there are significant differences in perceptions between groups, in general, all groups have high expectations for the future development of the SCPA model, with each group having somewhat different views on how the model should be developed to better support the ongoing development needs of athletes.

3.2.4. The Need for Structured Performance Indicators

The ANOVA test on the dimension of The Need for Structured Performance Indicators was conducted to evaluate whether there was a significant difference in perception between groups of participants regarding the importance of structured performance indicators in coach assessment. Clear and structured performance indicators are essential to objectively measure athletes' development and achievement and to ensure that the talent selection process and athlete development is carried out in a sustainable manner and by LTAD principles. The results of the analysis are shown in Table 12 and Table 13.

Table 12.
ANOVA - The Need for Structured Performance Indicators

Cases	Sum of Squares	df	Mean Square	F	p
Role/Position	52.890	2	26.445	2.452	0.113
Residuals	204.929	19	10.786		

Note. Type III Sum of Squares.

Table 13.
Descriptive - The Need for Structured Performance Indicators.

Role/Position	N	Mean	SD	SE	Coefficient of variation
Academics	7	19.714	1.799	0.680	0.091
Assistant coach	7	18.000	4.472	1.690	0.248
Coach	8	21.750	3.059	1.082	0.141

The results of the ANOVA test analysis presented in Table 12 showed a value of F = 2.452 with p = 0.113, which means that there was no significant difference in perceptions between groups regarding the importance of structured performance indicators ($p > 0.05$). However, although not significant, a considerable F value indicates a tendency that differences in perception between the participant groups (lead coaches, assistant coaches/administrators, and academics) still exist. Table 13 provides a further overview of the descriptive outcomes of each group of participants. The main coaching group had the highest average (mean = 21,750) compared to the academic (mean = 19,714) and assistant coach (mean = 18,000) groups. This shows that the main coach has a higher perception of the importance of structured performance indicators in coach assessment. This may reflect their deeper understanding of more organized and systematic assessment practices in athlete development.

In terms of data variation, the assistant coach group showed the largest standard deviation (SD = 4.472) and coefficient of variation (CV = 0.248), indicating a more diverse perception of the importance of structured performance indicators. In contrast, the primary coach group had smaller standard deviations (SD = 3.059) and a lower coefficient of variation (CV = 0.141), suggesting that perceptions among them were more homogeneous related to the importance of structured performance indicators. Overall, although there were no significant differences, these results indicated that all groups of participants considered the presence of structured performance indicators important in coach assessments, although the level of importance varied between groups. Clear and organized performance indicators are fundamental in supporting the development of athletes in accordance with LTAD principles [23].

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4. Discussion

This study identifies the perceptions of trainers and key informants that lend support to such the perception that there was a need for an LTAD-guided performance assessment model. The affirmations of dimensions that are very relevant to the needs of the design of this assessment model derive from the aforementioned analysis and are mainly linked to the limitations of current talent selection practices, support for the implementation of LTAD-based assessment processes, aspirations related to the future configuration of the SCPA model and the determination of structured performance indicators.

In Limitations of Current Talent Selection Practices dimension, the results of the study showed that there was no difference between the two groups that were made, but most of the participants sensed the need for improvement in current talent selection practices. The selection procedure should ideally reflect not only current physical ability but also future potential and development in the framework of LTAD, also supported by Allan, et al. [24] and Pichardo, et al. [7]. One of the barriers to establishing an optimal athlete development pathway is the same issue of limitations in talent selection practices [25]. The findings of this study suggest the necessity of adopting a system of assessment that is more versatile and holistic than the old-fashioned and narrow method of talent selection.

In the Support for LTAD-Based Assessment Integration dimension, although the ANOVA results revealed no significant differences in perceptions among the groups, the majority of respondents demonstrated a strong proclivity toward integrating LTAD-based assessments. This finding is consistent with research carried out by Beaudoin, et al. [26] notes that LTAD-based assessments assist coaches and sports managers in developing a comprehensive plan for the long-term progression of athletes through the use of LTAD assessment systems and allow better decision-making regarding athlete development [27-29]. Step one shows this path, and the implementation of LTAD-based assessments will present a fuller picture of the athletes who are more accountable for their potential [30].

Dimension-The Expectations for the Future Dimension of the SCPA Model exhibits a stark variation of perception between the top and bottom group of participants. However, the differences in expectation of the future direction of the SCPA model between groups suggest that the main coaching group possess a more thorough grasp of the rationale for implementing a more structured assessment model and are subsequently better positioned to paint clarity to the process of athlete development across the lifespan. Emerging from the results, meanwhile, is the finding that better educators understand that not only do they know how their athletes are developing, they also understand that assessment models may vary with time and level of athlete development [29].

Moreover, results of the ANOVA test were significant = no difference in The Need for Structured Performance Indicators, however these findings further indicate the need to look at which performance indicators are used to measure athletes and whether we should have structured performance indicators in general. According to Sannicandro [31] structured performance indicators are used by coaches to evaluate the performance of their athletes in order to identify the abilities of athletes in a more accurate, systematic, and efficient way in addition to speeding up the talent selection and athlete development process by conducting both in a disciplined manner by LTAD principles [32, 33]. It is also due to the necessity to possess evaluation tools capable of gauging athlete evolution in different aspects: physical, technical, mental and social [34].

In summary, the results from this study underscore the urgent need of creating a more balanced, adaptable, and formal LTAD-based athlete assessment model. Also, this study also gives evidence that while there are some differences in perceptions across groups of participants, it appears there is a consensus on the importance of utilizing LTAD-based assessments for sustainable athlete development. Hence, incorporating such aspects will be highly beneficial in referring to a model of structuring the athlete selection and coaching system in a more reliable and evidence-based manner.

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5. Conclusion

The implications of this study suggest leveraging LTAD-based performance assessment within athlete coaching. The results indicate that, although participants' groups are not significantly different across some dimensions, they are in consensus on the need to: better practices of talent selection and integration of LTAD-based assessments. Findings also indicate that lead coaches anticipate future developments of SCPA model to a greater extent than by the other groups, whilst structured performance indicators are being taken seriously by all groups. These findings highlight the need to develop a more formalized and adaptable LTAD-specific SCPA model, which is necessary to reduce the inefficiencies in athlete development.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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