A Rasch model analysis of leadership potential among young athletes in Indonesia

Un modelo Rasch análisis del potencial de liderazgo entre los jóvenes atletas de Indonesia

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Abstract

Introduction: Leadership in contemporary sport was understood as a psychosocial capacity shaping team dynamics and long-term athlete development. However, empirical mapping of leadership potential among young athletes in developing contexts remained limited.
Objective: This study aimed to analyze and map the leadership potential of young athletes in Indonesia using a Rasch measurement approach, examining its structure and differences based on gender, leadership activities, and organizational interest.
Methodology: A quantitative cross-sectional design was employed with 642 university athletes aged 17 to 20 years. The Youth Leadership Potential Scale, consisting of 23 Likert-type items, was adapted into Indonesian and administered online. Data were analyzed using the Rasch model to assess item fit, reliability, dimensionality, and person-item distribution.
Results: The findings indicated excellent psychometric properties, with person reliability of 0.92, item reliability of 1.00, and internal consistency of 0.93. The scale demonstrated strong measurement precision and unidimensionality. The most challenging item concerned maintaining concentration under pressure, while conceptual knowledge of leadership roles was the easiest. Gender differences were not substantial. Higher leadership potential was associated with prior organizational experience, holding leadership positions, and a strong interest in campus organizations.
Discussion: These findings aligned with contemporary perspectives emphasizing experiential learning and shared leadership rather than gender-based assumptions. Leadership potential is developed through active engagement in organizational and leadership activities, consistent with research highlighting the role of social participation and psychological readiness in shaping leadership capacity.
Conclusions: Leadership potential among young athletes was a dynamic construct shaped more by experiential involvement than by gender. An inclusive and experience-based developmental ecosystem is essential to cultivate adaptive and resilient young leaders in sport and higher education.

Keywords

Leadership potential; young athletes; Rasch model; sport leadership; psychometric validation.

Resumen

Introducción: El liderazgo en el deporte contemporáneo se entendía como una capacidad psicosocial que configuraba la dinámica del equipo y el desarrollo a largo plazo de los atletas. Sin embargo, el mapeo empírico del potencial de liderazgo entre los atletas jóvenes en contextos en desarrollo seguía siendo limitado.
Objetivo: El objetivo de este estudio era analizar y mapear el potencial de liderazgo de los atletas jóvenes en Indonesia utilizando un enfoque de medición Rasch, examinando su estructura y diferencias en función del género, las actividades de liderazgo y el interés organizativo.
Metodología: Se empleó un diseño cuantitativo transversal con 642 atletas universitarios de entre 17 y 20 años. La Escala de Potencial de Liderazgo Juvenil, que consta de 23 ítems de tipo Likert, se adaptó al indonesio y se administró en línea. Los datos se analizaron utilizando el modelo de Rasch para evaluar el ajuste de los ítems, la fiabilidad, la dimensionalidad y la distribución persona-ítem.
Resultados: Los resultados indicaron excelentes propiedades psicométricas, con una fiabilidad de la persona de 0,92, una fiabilidad de los ítems de 1,00 y una consistencia interna de 0,93. La escala demostró una gran precisión de medición y unidimensionalidad. El ítem más difícil fue el relativo al mantenimiento de la concentración bajo presión, mientras que el más fácil fue el relativo al conocimiento conceptual de las funciones de liderazgo. Las diferencias de género no fueron sustanciales. Un mayor potencial de liderazgo se asoció con la experiencia previa en organizaciones, el desempeño de puestos de liderazgo y un gran interés en las organizaciones del campus.
Discusión: Estos hallazgos coinciden con las perspectivas contemporáneas que enfatizan el aprendizaje experiencial y el liderazgo compartido, en lugar de los supuestos basados en el género. El potencial de liderazgo parecía desarrollarse a través de la participación activa en actividades organizativas y de liderazgo, en consonancia con las investigaciones que destacan el papel de la participación social y la preparación psicológica en la formación de la capacidad de liderazgo.
Conclusiones: El potencial de liderazgo entre los jóvenes deportistas era un constructo dinámico moldeado más por la participación experiencial que por el género. Un ecosistema de desarrollo inclusivo y basado en la experiencia es esencial para cultivar líderes jóvenes adaptables y resilientes en el deporte y la educación superior.

Palabras clave

Potencial de liderazgo; jóvenes atletas; Modelo Rasch; liderazgo deportivo; validación psicométrica

Introduction

Leadership in the context of modern sport is understood as a psychosocial capacity that plays a crucial role in shaping team dynamics, team interactions, and the sustainability of athlete performance (Cotterill et al., 2022a; Mach et al., 2022; Wittinghan et al., 2026). Leadership in young athletes encompasses the ability to influence peers, manage competitive pressure, and demonstrate initiative in training and competition situations (Nakayama & Izawa, 2025; Yenen et al., 2023). Numerous studies in sport psychology have shown that leadership contributes to team cohesion, motivation, and a healthy competitive climate, ultimately supporting the long-term development of athletes (Butalia et al., 2025; Oh, 2024).

In various countries, leadership development for young athletes has become a crucial urgency in holistic athlete development. Young athletes are not only prepared to achieve but also to become responsible individuals capable of playing a positive role in their teams and social environments (Coker et al., 2022; Corti et al., 2023; Lisá et al., 2023; Grubertt et al., 2024; López et al., 2026). One of the main challenges in the study of youth athlete leadership is how to define and measure leadership potential meaningfully. Many studies emphasize visible leadership behaviors or formal roles, thus under-capturing latent dimensions such as leadership readiness, value orientation, and tendency to take initiative (Butalia et al., 2024; Cotterill et al., 2022b). Instruments such as the Youth Leadership Potential Scale (YLPS) developed by Yuan et al. (Yuan et al., 2019) offer a more comprehensive approach by viewing leadership as a construct encompassing cognitive, attitudinal, and skill aspects (Yuan et al., 2019). However, the use of this kind of instrument in a different cultural context and sports development system, such as in Indonesia, requires careful empirical testing so that the interpretation of the measurement results truly reflects the condition of young athletes.

In this study, leadership potential is conceptualized as a latent psychosocial construct that reflects an individual's readiness and capacity to assume leadership roles in sport contexts. It extends beyond observable leadership behaviors by encompassing underlying dimensions such as cognitive readiness, value orientation, self-regulation, and the tendency to initiate and influence others in dynamic team environments (Ndubuisi et al., 2025; Windasari et al., 2025). Unlike leadership performance, which refers to enacted behaviors in specific situations, leadership potential represents the developmental capacity that may manifest when opportunities for leadership emerge. Therefore, leadership potential is positioned as a multidimensional construct that requires measurement approaches capable of capturing both individual differences and latent trait characteristics (Batista-Foguet et al., 2021).

Beyond measurement issues, studies of youth athlete leadership also need to consider intergroup variations. Gender has long been a central issue in leadership and sport studies, given the differences in social experiences, participation opportunities, and role expectations between male and female athletes (Kim & Cruz, 2022; Onea & Alecu, 2025). However, prior studies often treat gender differences descriptively, without critically examining the underlying mechanisms that shape these differences. In many cases, observed variations in leadership tendencies may not solely reflect inherent differences in leadership capacity, but rather differences in socialization processes, access to leadership opportunities, and culturally embedded expectations in sport contexts.

Moreover, limited attention has been given to the possibility that measurement instruments may function differently across gender groups. Without considering potential measurement bias, comparisons between male and female athletes may lead to oversimplified or even misleading conclusions. Therefore, a more critical approach is needed, positioning gender not only as a comparative variable but also as a factor that may influence both the development and the measurement of leadership potential (Sims et al., 2021). Furthermore, athletes' involvement in various leadership activities and their interest in participating in sport organizations are also thought to play a role in the development of leadership skills (Correia-Harker et al., 2025a; Hartoyo et al., 2024). However, the relationship between these factors and the leadership potential of young athletes in Indonesia has rarely been studied in an integrated manner within a single empirical framework.

Although youth athlete leadership has been widely discussed in the international literature, to date, very little research has systematically mapped the leadership potential of young athletes in the context of developing countries, particularly Indonesia, using a measurement approach that allows for objective comparisons across individuals and groups. Furthermore, empirical evidence integrating gender, involvement in leadership activities, and organizational interests into a single analytical framework for

youth athlete leadership potential remains scarce. This gap highlights the need for research that not only describes the general level of leadership but also maps the structure of youth athlete leadership potential in greater depth and context.

In response to these weaknesses, this paper employs the Rasch measurement model, which has many benefits over old-style methods like Classical Test Theory (CTT). For one, Rasch analysis can take ordinal data and convert it into interval-level measures (Hopkins et al., 2021). Also, this kind of analysis can reveal minute details of each item/problem/word. In addition, it can separate the respondent's ability level and the item's difficulty level (Hopkins et al., 2021). A very important aspect of the Rasch model is that it makes it possible to check measurement invariance across different groups using Differential Item Functioning (DIF), so that one can be sure that comparisons (for example, between boys and girls) are not distorted by the items themselves. This is very important in the field of youth athlete leadership, where measurement without bias and with full accuracy is the main prerequisite to differentiating individuals and using the results for building a school of leadership based on the evidence.

Based on the preceding discussion, leadership potential is identified as the main latent variable here, whereas gender, participation in leadership activities, and organizational interest are regarded as the most important factors that can influence both the development and measurement of ability for leadership (Zhang et al., 2023). These factors are not just treated as descriptive features, but as important aspects that help in understanding the context of how leadership potential is spread and expressed in young sportspeople. By placing these factors into the same analytical framework, the paper intends to yield the broadest and most refined understanding of athlete leadership among youth in Indonesia.

Based on this framework, this study aims to analyze and map the leadership potential of young athletes in Indonesia using a Rasch-based measurement approach. Specifically, this study examines the structure of young athletes' leadership potential, examining its differences in terms of gender, and linking it to leadership activities and organizational interests. The main contribution of this study is to provide a sharper and more contextual empirical picture of the leadership potential of young Indonesian athletes, which can serve as a basis for the development of more targeted and data-driven leadership development programs in physical education and sports.

Method

Participants

Participants in this research were recruited through a non-probability approach, specifically convenience sampling. The target population of this study consisted of university students enrolled in sports related programs across Indonesia; however, due to the absence of a centralized database, the exact population size could not be determined. Participants were recruited through online distribution, which may limit the generalizability of the findings. The participants were sports students at universities in Indonesia. The Youth Leadership Potential Scale (YLPS) instrument was then adapted into Indonesian with a total of 23 statements. Data collection using the YLPS was conducted from October 2025 to January 2026. Data were collected online through Google Forms. Before completing the questionnaire, respondents were informed of the purpose of the study, that they were not required to provide personal information, and that the data provided would be kept confidential. Data collected amounted to 642 respondents consisting of 374 men and 268 women, with an average age of 18.28 years (see table 1). The basis used in the data cleaning process was the Outfit MNSQ score criteria, which ranged from 0.5 to 1.5 (Ariyanto et al., 2025; Bond & Fox, 2013; Soejanto et al., 2026).

Table 1. The Demographic Details of The Participants (I=23, N =642)

Demographic	Total	Mean Measure	S.E Mean	Model Reliability
Gender				
- Male	374	1.73	0.08	0.94
- Female	268	1.62	0.09	0.92
Age				
- 17 years	30	2.03	0.27	0.93
- 18 years	277	1.58	0.10	0.94
- 19 years	268	1.83	0.08	0.92

- 20 years	67	1.39	0.14	0.89
Province				
- Bali	3	1.27	0.48	0.67
- Banten	5	1.12	0.34	0.68
- Central Java	218	1.6	0.1	0.93
- East Java	350	1.8	0.08	0.94
- East Kalimantan	4	2.18	1.17	0.96
- Jakarta	29	1.42	0.2	0.86
- Papua	13	1.15	0.35	0.9
- South Sumatra	3	0.68	0.15	0
- West Java	14	1.78	0.54	0.96
- West Nusa Tenggara	3	1.76	0.65	0.82
Previous organizational experience				
- Extracurricular Activities	327	1.60	0.08	0.93
- Student Council	131	2.05	0.14	0.93
- Religious Organizations	53	1.89	0.15	0.87
- Others	57	2.27	0.21	0.93
- None	74	0.84	0.14	0.90
Held a school leadership position				
- Yes	195	2.03	0.11	0.93
- No	447	1.54	0.07	0.93
Interest in participating in campus organizations				
- High	190	2.35	0.11	0.93
- Moderate	412	1.41	0.07	0.92
- Low	40	1.38	0.24	0.94
Expectations toward campus leadership				
- Advocating for students aspirations	88	1.86	0.19	0.95
- Fostering a safe and inclusive campus environment	190	1.44	0.08	0.87
- Serving as role models and sources of inspiration	112	1.59	0.18	0.95
- Supporting students personal development	252	1.86	0.09	0.93

*) Data collected and modified by the authors.

Instrument

The YLPS scale is a scale developed to measure the extent of youth leadership potential, which includes knowledge, attitudes, and skills. In this study, the YLPS is considered as a unidimensional latent variable that measures the youth leadership potential entirely, all the items are assumed to be reflective of a single underlying trait. Even if the scale conceptually covers different aspects like knowledge, attitudes, and skills, these dimensions are considered as combined indicators of one construct. This is in line with the Rasch measurement model's requirement for unidimensionality to produce valid measures and meaningful interpretations of person ability and item difficulty estimates.

This scale was first developed by Yuan et al. in 2019 (Yuan et al., 2019). In the YLPS, the answer choices for each item are arranged in a Likert scale format, ranging from 1 to 5. This scale is used to assess the frequency or intensity of ideational behavior measured by the item, with the following answer choices: strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).

To provide a clearer understanding of the instrument content, several representative items are presented. For example, items related to leadership knowledge include “I understand the responsibilities of a leader” and “I understand the concept of leadership.” In terms of leadership attitude, items such as “I am confident in my ability to lead others” reflect individuals’ readiness to assume leadership roles. Meanwhile, skill-based dimensions are represented by items such as “I am a good listener when others share their opinions” (communication skills), “I can analyze problems before making decisions” (decision-making skills), and “I stay calm when dealing with difficulties” (stress management skills).

Data analysis and statistical analysis

Rasch is a psychometric approach that emphasizes Item Response Theory. Using the Rasch model in this study is intended to provide more objective measurement by transforming ordinal data into interval-level measures, allowing for independent estimation of person ability and item difficulty.. Also, Rasch analysis offers a detailed look into individual items and can test measurement invariance across groups, which is a must for making fair comparisons among participants.

This allows for simultaneous measurement of item and person quality, allowing for the items designed into an instrument to be categorized from the most difficult to the easiest (Bariyyah et al., 2025; Ifdil., et al., 2024; Andrianie, et. Al., 2024). Field data from Rasch observations and measurements were measured using Winsteps software version 5.1.5 (Andrianie et al., 2025).

Ethics Approval

This study adheres to ethical principles by ensuring participant confidentiality. The participants consented to participate in this study and the publication of the results in accordance with ethical approval. Ethical approval Number: 1200/EC/IKI/IVI/2026 was obtained from Ikatan Konselor Indonesia (IKI), Indonesia.

Results

Measurement objectivity and Rasch fit

Measuring the leadership potential of youth athletes begins by examining the quality of items and individuals according to ideal conditions. Ideal scores are considered within the MNSQ OUTFIT score range of 0.5–2.00 logit (Ifdil, et al., 2024). The Youth Leadership Potential Scale (YLPS) yielded an average score of 0.92 logit for 23 items, indicating excellent item quality for measurement. This result indicates that 642 respondents had an ideal quality for measurement.

Findings from the Rasch analysis applied to the YLPS scale are documented in Table 2. The individual reliability index of 0.92 indicates significant consistency among respondents, while the item reliability index, at 1.00, reflects exceptional reliability. Furthermore, a Cronbach's alpha score of 0.93 confirms the reliability of the Youth Leadership Potential Scale (YLPS).

Table 2. Overview of Person and Item Statistics under the Rasch Model (I=23, N =642)

	Measurement Reliability	Sep. Index	Mean or logit*)	α Coefficient	Explained Variance (%)**)
Person	0.92	3.47	1.69	0.93	50.2%
Item	1.00	15.12	0.00		

*) Logit Scale Measurement.
**) Calculated using Principal Component Analysis (PCA)

Unidimensionality denotes how well all the items in the Youth Leadership Potential Scale (YLPS) capture just one underlying factor (Brentari et al., 2007). The scale showed a great deal of variance that was explained (50.2%), more than the suggested level (>40%), and the variance that was not explained in the first contrast was still under 15% (7.9%). Based on the results, the unidimensionality premise of the YLPS can be considered to have been met.

Among YLPS items, the evaluation of local dependency has shown 10 positive correlations. The largest correlation with a value of 0.45 was found between item 9 (I have a strong desire to become a leader) and item 10 (I enjoy opportunities to take on a leadership role). Both items aim to assess the respondent's viewpoint about leadership. Although the two items are closely linked in terms of concepts, each one represents a different facet of leadership attitude, which keeps their overlap at a minimum. Besides that, the data show that local dependency is unlikely to constitute a significant problem, as the standardized residual correlations between YLPS item pairs did not exceed the upper limit of 0.70 in the positive direction (Linacre, 2009).

Threshold: partial credit model

Measuring the leadership potential of youth athletes begins by assessing the quality of items and individuals according to ideal conditions. Ideal scores are considered within the MNSQ OUTFIT score range of 0.5–2.00 logit (Ifdil, et al., 2024). The Youth Leadership Potential Scale (YLPS) yielded an average score of 0.92 logit for 23 items, indicating excellent item quality for measurement. This result indicates that 642 respondents had an ideal quality for measurement.

A clearly structured and unambiguous scale allows respondents to select the correct answer. The assessment scale must be presented clearly for easy understanding. A five-category Likert response scale was used in the assessment and is outlined in Table 3

Table 3. Evaluation of Rating Scale Functioning and Threshold Ordering in Rasch Analysis (I=23, N =642)

Category	Score	Andrich Threshold	Average Measure	Response Frequency (%)	Infit MNSQ	Outfit MNSQ
Strongly disagree	1	NONE	-1.76	0	0.85	0.79
Disagree	2	-4.46	-.077	6	0.89	0.88
Neutral	3	-1.91	0.71	42	1.03	1.04
Agree	4	1.48	2.36	42	1.01	1.00
Strongly agree	5	4.89	4.60	10	1.04	1.03

Table 3 confirms that respondents clearly understood the answer choices on the YLPS Scale without confusion. This finding is validated by the increasing trend in the observed mean logit and Andrich Thresholds, ranging from the lowest category (NONE) to a maximum value of 4.89 logits.

Figure 1. Probability and empirical categorical curves of YLPS

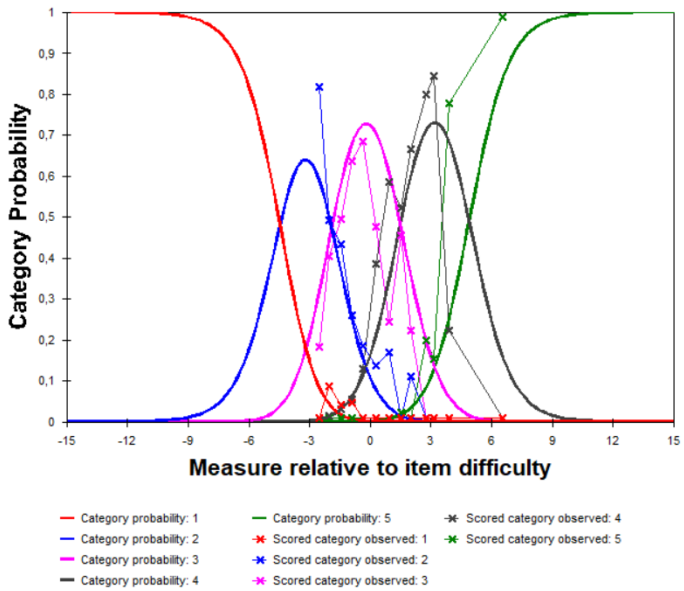


Figure 1 shows the response points provided by the YLPS Scale as a standard curve, with response points 1, 2, 3, 4, and 5 already understood by respondents, as indicated by the peak of the curve at each response point. The research findings indicate that all four answer options provided on the instrument are valid and that respondents were not confused when answering. However, one response point should be removed from the YLPS Scale answer options. Following expert findings, the hill-shaped curve indicates response points on the instrument that respondents easily understand.

Gender-Based Analysis of Leadership Potential among Young Athletes

The YLPS item assessment revealed that item 20 ("I can maintain concentration in stressful situations.") had the highest level of difficulty for all respondents (1.78 logits). This indicates that the ability to maintain concentration in stressful situations is the most challenging aspect for respondents in the context

of youth athlete leadership. This finding indicates that the dimension of self-regulation under pressure is not as well developed as the conceptual understanding of the leadership role.

In contrast, item 1 of the YLPS instrument showed the the smallest logit estimate (-2.07 logit) compared with other items, implying that the statement "I know what a leader's responsibilities are" was the one received the highest level of agreement from participants. This reflects a relatively good conceptual understanding of leadership roles and responsibilities among students. This finding indicates that the cognitive aspects of leadership are easier to master than the skills or practical aspects of leadership.

Table 4. Student Enright Forgiveness as Measured by Item Logit (I=23, N =642)

Item	Total Score	Logit	S.E Model	Infit MNSQ	ZSTD	Outfit MNSQ	ZSTD	Pt. Measure Corrr
20	1908	1.96	0.07	1.28	4.5	1.28	4.5	0.66
9	1942	1.78	0.07	0.84	-3	0.84	-2.97	0.71
8	1985	1.56	0.07	0.85	-2.7	0.85	-2.69	0.68
14	2102	0.95	0.07	1.09	1.58	1.11	1.85	0.6
7	2104	0.94	0.07	1.13	2.14	1.12	1.92	0.64
19	2105	0.94	0.07	1.16	2.65	1.2	3.13	0.58
10	2115	0.88	0.07	1.14	2.25	1.13	2.1	0.67
12	2170	0.59	0.07	0.75	-4.81	0.74	-4.77	0.66
22	2190	0.48	0.07	0.97	-0.49	0.97	-0.46	0.65
16	2195	0.46	0.07	0.9	-1.88	0.9	-1.81	0.54
21	2206	0.4	0.07	1.29	4.72	1.28	4.4	0.56
23	2218	0.33	0.07	0.89	-2.07	0.89	-2.02	0.6
13	2236	0.24	0.07	0.95	-0.93	0.94	-1	0.65
15	2268	0.07	0.07	0.88	-2.2	0.87	-2.35	0.64
4	2405	-0.67	0.07	1.05	0.97	1.04	0.61	0.63
6	2446	-0.89	0.07	0.89	-2.06	0.9	-1.71	0.63
18	2452	-0.92	0.07	0.89	-2.02	0.9	-1.76	0.57
17	2497	-1.17	0.07	1.32	5.46	1.34	4.9	0.48
2	2511	-1.24	0.07	0.86	-2.77	0.83	-2.78	0.63
5	2526	-1.33	0.07	1.04	0.73	1.01	0.18	0.65
11	2549	-1.46	0.07	1.2	3.48	1.18	2.64	0.47
3	2617	-1.84	0.08	0.72	-5.54	0.72	-4.26	0.64
1	2656	-2.07	0.08	0.78	-4.21	0.76	-3.45	0.62

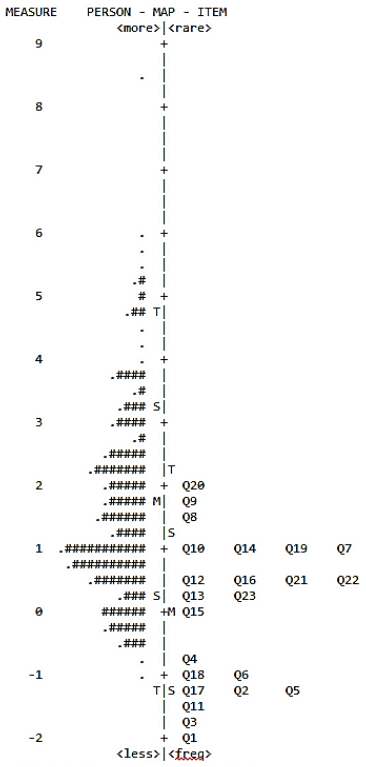
Table 5 lists the top five and bottom five responses out of 642 students, according to Rasch analysis. The person with the highest measure of innovation was no. 277 M, an 18-year-old male student from East Java, with a personal measure of +8.51 logit. On the other hand, the female with the lowest score was student no. 192 F (19 years old) from East Kalimantan, who had the lowest personal measure of -0.88 logit.

Table 5. Person-Level Measurement and Fit Statistics YLPS (I=23, N =642)

Respondent Code	Sum Score	Logit Score	SE (Model Estimate)	Infit MNSQ	ZSTD	Outfit MNSQ	ZTSD	Pt. Measure Corr.
top five responses								
277 M	114	8.51	1.04	1.03	0.33	0.68	0.21	0.17
462 F	114	8.51	1.04	1.03	0.33	0.67	0.20	0.18
818 M	114	8.51	1.04	1.03	0.33	0.68	0.21	0.17
208 F	108	6.03	0.48	1.44	1.44	1.01	0.18	0.56
250 M	108	6.03	0.48	1.68	1.68	1.50	1.10	0.20
bottom five responses								
192 F	64	-0.88	0.37	0.63	-1.37	0.64	0.53	0.64
436 M	65	-0.75	0.37	1.41	1.33	0.59	0.53	0.59
1083 M	66	-0.61	0.37	1.12	0.48	0.61	0.53	0.61
1036 F	66	-0.61	0.37	1.12	0.48	0.61	0.53	0.61
868 M	66	-0.61	0.37	0.97	-.02	0.59	0.53	0.59

*) Notes: M (male respondance); F (female respondance)

Figure 2. Wright map YLPS (I=23, N =642)



This pattern is also evident from the Wright Map (Figure 1) that shows the distribution of respondent ability and item difficulty on the logit scale. Wright map is also used to locate the ability of respondents and the difficulty of items on the same scale after estimating the parameters of items. Figure 1 shows that the item categories are divided into three parts: items that are difficult for respondents to understand (20, 9, 8); items that are moderately understood by respondents (10, 14, 19, 7, 12, 16, 21, 22, 13, and 23) and items that are easiest for respondents to understand (15, 4, 18, 6, 17, 2, 5, 11, 3, 1).

The DIF analysis

In the Gender subgroup, we found that 6 of the 23 YLPS items indicated DIF (prob <0,05), e.g,: (1) item 6 (0,01) – I know what skills a leader should have.; (2) item 7 (0.01) – I want the opportunity to be a leader; (3) item 9 (0,01) – I have a strong desire to be a leader; (4) item 10 (0,00) – I would be happy if there was an opportunity to be a leader; (5) item 14 (0,03) – I am good at speaking clearly so that others can understand, and ; (6) item 7 (0,03) – I make decisions based on the information available.

Nevertheless, interpreting the outcomes of our DIF study needs to be done quite cautiously. Take the scenario of an item showing a DIF, does it indicate that the item is "unfair"? Boone et al., (2013),explain that having a DIF on a test item does not imply that the item is "unfair" for different groups of respondents. Theoretically, a test item that shows DIF is one that the male and female groups understand quite differently. Thus, Linacre (2022) suggested an effect size measurement through DIF Contrast estimation that might give a clue whether different responses to a test item by different groups are significant (Chang et al., 2021; Zhu & Aryadoust, 2019, 2020). The findings of the DIF contrast investigation on the 6 items showing the DIF on the YLPS are indicated on the Table 6.

Table 6. Results of DIF Contrast Analysis on YLPS items (I=23, N =642)

	I-6	I-7	I-9	I-10	I-14	I-18
Male	-0.37	0.39	0.37	0.44	-0.31	-0.32
Female	0.37	-0.39	-0.37	-0.44	0.31	0.32

*) Data obtained from Differential Item Functioning (DIF) analysis using Winsteps
**) Notes: I-6 (item 6), I-7 (item 7), I-9 (item 9), I-10 (item 10), I-14 (item 14), I-18 (item 18)

As presented in Table 6, out of the six items, not one had their effect size exceeding the DIF Contrast (>0.64 logit). Hence, the inclusion of these six items in the YLPS should not compromise the accuracy of measurement.

Discussion

Gender in Relation to Young Athletes Leadership

The results of the research reveal that male and female differences are not the main factors in, determining leadership potential among young athletesLeadership potential is shaped by variations in psychological readiness and self-management capacity, particularly through the fulfillment of basic psychological needs such as self-determination and competence (Correia-Harker et al., 2025a; Li et al., 2025; Rija, et al., 2026). These findings support the finding that men and women have equal opportunities to develop leadership capacity (Correia-Harker et al., 2025b; Darvin et al., 2025; Laguna-Sánchez et al., 2021).

The differences that emerge are more likely influenced by factors such as organizational experience, intensity of involvement in leadership activities, and exposure to situations that require decision-making under pressure (Abdallah, 2024; Paustian-Underdahl et al., 2024; Smith et al., 2021). Conceptually, these findings align with the contemporary view that leadership can be learned and practiced through social experiences, interactions, shared experiences, and collective leadership practices, including in the shared leadership model, which encourages collaboration and motivation to achieve common goals, so that leadership skills are formed and can be applied in various life contexts (Whales et al., 2022, 2025; Sari, Andrianie, Pohan, 2026).

The findings of this study have implications for higher education practice and the development of young athletes, highlighting the need to design leadership development programs that are sensitive to individual differences but avoid assumptions about gender-based differences. This approach has the potential to produce young leaders who are more adaptive, resilient, and relevant to the demands of both academic and competitive environments.

Leadership Activities in Young Athletes

Leadership activities for young athletes are a dynamic competency in developing leadership potential. The involvement of young athletes in leadership activities not only enriches their understanding of the role of a leader but also serves as an experiential learning tool to hone self-management, decision-making, and social responsibility skills (Albuquerque et al., 2021; Algier et al., 2025; Erikstad et al., 2021; Escafi, et. Al., 2025). Furthermore, leadership activities can be enriched through traditional games as a form of contextual learning (Egan, 2024; Egan & Banter, 2022). These games require cooperation, role-playing, and communication, thus practicing leadership in real-life social situations. Because they encompass diverse cultural values, traditional games also contribute to strengthening multicultural understanding through experiences of interaction and appreciation of differences (Egan, 2024; Saura & Zimmermann, 2021).

The quality and diversity of leadership experience are more important factors than simply holding a formal role. Exposure to situations that require team coordination, problem-solving, and self-control contributes to strengthening student athletes' psychological readiness to assume leadership roles (Batten et al., 2025; Gosai et al., 2023; López de Subijana et al., 2021). Thus, leadership activities can be understood as an important medium that bridges the gap between leadership knowledge and the actual capacity to practice it.

The implications that can be applied based on this research to coaching practices in higher education and sports environments are the importance of designing activities that provide real opportunities for student athletes to develop their leadership potential sustainably, not only through classroom-based training, but through meaningful leadership experiences.

Organizational Interest and Leadership Skills in Young Athletes

Organizational interest plays a crucial role in developing the leadership potential of young athletes. Organizational involvement reflects an individual's readiness to participate in teamwork, share responsibilities, and engage in shared decision-making, which are core leadership practices (Renström et al., 2025; Wase Mola & Shaw, 2024). These experiences enhance communication, coordination, and self-regulation capacities in a realistic social context. In addition to strengthening leadership skills, interest and involvement in organizations are also linked to the development of grit and creativity in young athletes (Hwang et al., 2022; Pandey & K, 2025). Organizational dynamics demand perseverance in facing challenges, consistency in pursuing shared goals, and flexibility in finding solutions, thus fostering a fighting spirit and creative thinking skills (Ariyanto et al., 2024; Bouzouraa et al., 2025). In this context, organizational experience serves not only as a vehicle for strengthening leadership skills but also as a space for developing personal qualities that support leadership effectiveness in both academic and competitive situations. Conceptually, leadership potential develops through experiential learning and social interaction. In the context of sports and higher education, organizational experience serves as a relevant vehicle for strengthening leadership potential in a gradual and contextual manner (McCarron et al., 2022; Torrico et al., 2025). Consequently, youth athlete development programs and student policies need to actively facilitate organizational involvement, not merely as a supporting activity, but as a strategic component of leadership development. This approach has the potential to accelerate the transformation of leadership potential into competencies that can be demonstrated in academic and competitive situations. The Rasch analysis from a measurement standpoint unveils what youth leadership potential is structurally as a latent trait. Person ability and item difficulty locational maps suggest that young leaders do not possess leadership potentials of the same quality as each stage of psychological readiness and exposure to experience varies (Meyer & Rinn, 2021). As a result, they are lead to different leader-related item difficulties. Items with tougher difficulties exhibit leadership skills that are highly sophisticated, like making decisions and self-regulation under stress, whereas the simpler items usually signify very basic interpersonal skills such as communication and basic leadership awareness. This sequence implies that leadership growth is experiencing a step-by-step developmental route where initially acquired social and communication skills act as the platform for the emergence of leadership abilities at higher cognitive levels (Cardon et al., 2019; Pierce et al., 2020). Such impressions back up the theoretical proposition that leader potential is a trait that is not inherent, but the outcome of a continuous process of learning through experience and social interaction.

Furthermore, combining Rasch-based metrics and gender difference interpretation would lead to a higher level of understanding leadership potential (Sahebalam et al., 2026). Comparing the mean logit scores of male and female participants must always be done in conjunction with the concept of measurement invariance. Analyses of DIF show that, while several items demonstrate statistically significant differences, the magnitude of these differences is very small and there is no indication of substantial bias. In other words, these findings mean that gender differences in leadership potential are not majorly resulting from measurement artifacts (tools and procedures used to measure variables), but rather represent differences in experiential exposure and psychological readiness. As a result, gender differences are viewed very carefully and not as natural differences in leadership ability, but as mediated by social experiences and opportunities (Koçak et al., 2022).

This study has several methodological limitations that should be acknowledged. First, the use of convenience sampling may limit the generalizability of the findings, as the sample may not fully represent the broader population of young athletes in Indonesia. Second, although the Rasch model provides robust measurement properties, the cross-sectional design of this study limits the ability to capture changes in leadership potential over time. Future research is encouraged to employ more diverse sampling strategies and longitudinal designs to provide a more comprehensive understanding of youth leadership development.

Overall, this discussion confirms that the leadership potential of young athletes is a dynamic construct that develops through the interaction of individual factors, leadership experience, and organizational involvement. Gender differences do not emerge as the primary determinant, but rather interact with psychological readiness and experiential learning opportunities. Leadership activities and organizational experience serve as important contexts that bridge conceptual understanding and actual capacity to practice leadership. Consequently, leadership development in higher education and sports environ-

ments needs to be directed toward creating an inclusive, experiential, and sustainable learning ecosystem, so that young athletes' leadership potential can develop into adaptive, resilient competencies that are relevant to both academic and competitive demands.

Conclusions

This study aimed to analyze and map the leadership potential of young athletes in Indonesia using a Rasch measurement approach. The findings demonstrated that the adapted Youth Leadership Potential Scale functioned with strong psychometric properties, as evidenced by high item and person reliability, satisfactory separation indices, and a well-ordered response structure. These results indicated that the instrument was capable of producing objective and reliable measures of leadership potential within the Indonesian higher education sport context.

The analysis revealed that leadership potential was structured along varying levels of item difficulty, with conceptual understanding of leadership roles being more readily endorsed than self-regulatory capacities under pressure. This pattern suggested that cognitive awareness of leadership responsibilities had developed more strongly than the practical and psychological dimensions of leadership performance. Furthermore, gender did not emerge as a primary determinant of leadership potential, while variations appeared to be more closely associated with leadership activities and organizational engagement.

The study contributed to the field by providing one of the first Rasch-based mappings of young athletes' leadership potential in a developing country context, enabling more precise comparisons across individuals and subgroups. It advanced measurement practices in sport leadership research by integrating structural validation with contextual analysis.

Future research was recommended to expand the model across different educational levels and sport settings, and to employ longitudinal designs to examine how leadership potential evolved through sustained experiential and organizational involvement.

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