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Construction of Standardized Levels for Time Performance in School Cross-Country Running among Young Adolescents

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Abstract:

This study aimed to establish standardized levels for time performance in school cross-country running among young adolescents (boys 3000 m, girls 2000 m) to support objective assessment and talent identification. Using a descriptive-analytical approach, 47 boys and 34 girls were included from provincial final race results. Data were analyzed with descriptive statistics and percentiles, after confirming reliability through a pilot study (test-retest correlations: boys 0.96, girls 0.91). Results showed significant variability, particularly among girls, with non-normal distribution. Performance was classified into five levels: Excellent, Very Good, Good, Average, and Poor. Most students fell into Average or Poor categories, highlighting the need for targeted endurance training. The standardized scales provide a practical tool for educators and coaches to evaluate performance objectively, monitor development, and identify high-potential athletes. This percentile-based approach offers a fair and scientific method for assessing cross-country performance in school settings

Keywords: Cross-country running ; standard scale; Talent identification.

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1. INTRODUCTION

The study of talent in sports has been a subject of great interest across multiple scientific disciplines, including kinesiology, pedagogy, biology, psychology, and physiology. This interest arises not only because talent is a fundamental component of sustainable sports development but also because achieving competitive success in sports largely depends on possessing outstanding athletic talent, both physiologically and psychologically. **(Jie Zhao, 2024)**

Effective athlete selection is one of the key elements in building sustainable, long-term, and successful sports programs. This process is known by various terms, such as “athlete selection” and “talent identification,” and is closely linked to related practices, including “talent recognition” and “talent discovery.” For instance, Borms (1996, as cited in Williams & Reilly, 2000) defines “talent selection” as “an ongoing process of identifying players at different stages who demonstrate initial performance levels qualifying them to join a specific team or squad, including the selection of the most suitable individual(s) to perform a task in a given context.” Similarly, the New Zealand Sports Tribunal (2009) defines athlete selection as “nominating and/or selecting an individual to join a team or squad”. **(Johnston, 2025)**

Talent identification and selection often rely on Sport Talent Identification Systems (STIS), which involve multiple stages and dimensions tailored to the characteristics of each sport. Opinions vary regarding the application of talent identification systems at an early age **(Jesús L. Lozada-Medina^{1*}, 2025)**. Several leading sports organizations have implemented talent detection programs aimed at personalizing each athlete’s career trajectory and reducing the influence of socio-cultural and biological factors. These include relative age effects and differences in the chronological onset of growth spurts **(Bezuglov, 2024)**.

To detect sports talent, a fertile environment is required, such as school sports competitions within physical education programs, which have become one of the most important subjects in ensuring holistic development. Today, physical education is no longer a purely recreational activity aimed at strengthening muscles and joints; it has evolved into a scientific effort aimed at developing students physically, mentally, emotionally, morally, psychologically, and socially, ensuring the formation of a well-rounded and balanced personality. Schools play a key role in facilitating this development **(Aouinti, 2025)**. For example, in Denmark, physical education is part of the lower secondary curriculum, with 135 minutes per week from grades 7 to 9. PE lessons aim to enhance students’



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physical, athletic, social, and personal competencies and foster lifelong motivation for physical activity (**Hartman, 2024**).

Participation in school sports provides coaches and sports specialists with the opportunity to identify young talents. Among these sports, athletics—particularly cross-country running—stands out as a key discipline. Athletics training generally begins relatively late (around ages 9–10), and competitions are less frequent during childhood and adolescence, often spanning at least two consecutive birth years. In early stages, success is heavily dependent on strength and speed, while technique plays a lesser role due to limited training experience (**Bezuglov, 2024**).

Cross-country races and off-road running typically take place on uneven terrain, affecting physiological responses. While many studies on long-distance running focus on maximal oxygen consumption (VO_{2max}), sustainable VO_2 utilization during performance (linked to lactate and ventilatory thresholds), and running economy (RE) as main performance factors (**Rapp E, 2025**), school cross-country remains a vital educational sport activity that contributes to developing students' physical fitness and aerobic endurance. It also serves as an effective tool for detecting early sports talent. Nevertheless, research in this area is relatively scarce, and the lack of precise local standards for time performance assessment often means evaluation relies solely on ranking rather than scientific normative levels.

With societal development and technological advancement, sports increasingly depend on quantification and measurement. Athletics was likely the first sport to benefit from precise measurements of time and distance. The emergence of quantitative competition assessment enabled performance comparison even without direct competition (**Grammaticos, 2022**). However, comparing performances across different competitions remains challenging. While good models exist for long-distance running using physiological measures such as speed and running economy, these are mainly for intra-sex comparisons, not inter-sex comparisons (**Godsey, 2024**).

Talent identification in sports remains heavily biased toward competition results, particularly in sports measured in centimeters, grams, or seconds, such as athletics. Current literature indicates substantial errors in early talent identification based solely on initial results due to relative age effects (**Agudo-Ortega, 2024**). This underscores the importance of the present study, which aims to construct a



standardized scale for time performance based on actual results from the provincial finals of school cross-country races among young adolescents (boys 3000 m, girls 2000 m).

2-Hypotheses:

Considering the critical role of hypotheses in scientific research, and based on theoretical and empirical data, the hypotheses of this study are as follows:

1. There are significant differences in time performance among young adolescents.
2. A standardized scale can be constructed to assess time performance in school cross-country races.

3-Objectives:

- To construct standardized levels for time performance in school cross-country races for young adolescents.
- To classify students into performance levels (Excellent, Very Good, Good, Average, Poor).
- To provide a scientific tool to assist teachers and coaches in assessment and talent selection.

4-Methodology:

The descriptive survey method was adopted as it is appropriate for this type of research.

4-1-Population and Sample:

- **Population:** Young adolescents participating in school cross-country races.
- **Sample:**
 - Boys: 47 students, 3000 m.
 - Girls: 34 students, 2000 m.The sample was selected through a comprehensive census of provincial final results.

4-2-Data Collection Tools:

- Official race timing records.
- Data extraction forms.

4-3-Statistical Analyses:

- Arithmetic mean
- Standard deviation
- Range
- Skewness



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- Construction of standardized levels (percentiles)

4-4-Pilot

Study:

The pilot study involved 10 athletes from the original population who were not included in the main sample. They were randomly selected, and the pilot was conducted from 02 to 10 November 2025 using the same physical test employed in the main study. The objectives were:

- To assess the seriousness and responsiveness of the pilot participants.
- To introduce modifications to test elements and instructions.
- To ensure all dimensions of the measured trait were adequately represented.
- To identify weaknesses during application and make appropriate adjustments.
- To familiarize the assisting team with the tests and their administration.
- To ensure validity, reliability, and objectivity conditions.

4-5-Psychometric

Properties

of

the

Test:

-Test

Reliability:

Test-retest reliability was assessed using 5 athletes from the research population (excluded from the main sample) from 02 to 10 November 2025. The test was repeated after 7 days under identical conditions to minimize potential variables affecting results

Table 1. Mean and Sum of Differences for the First and Second Measurements of the Pilot Study Sample

Distance	Sample Category	Sample Size	Significance Level (α)	Correlation Coefficient (Test-Retest)
3000 m	Young Adolescent Boys	5	0.05	0.96
2000 m	Young Adolescent Girls	5	0.05	0.91

The results presented in Table 1 show that the correlation coefficient between the first and second measurements was 0.96 for boys and 0.91 for girls, indicating statistically significant and highly reliable measurements, approaching a perfect correlation of 1.

- Test Validity
To ensure the validity of the tests, the researcher calculated the self-validity coefficient, defined as the square root of the reliability coefficient:

$$\text{Intrinsic Validity} = \sqrt{\text{Reliability}}$$

- Objectivity
Test objectivity refers to the degree to which different evaluators produce consistent results when assessing a given variable. Since the test employed in this study relies on measurement devices such as timing instruments and measuring tapes, it is clear, easy to use, and free from subjective interpretation. The physical test was applied and adjusted according to the recommendations of supervising professors, ensuring that it was conducted under conditions of high objectivity.

Table 2. Normality Distribution

Group	n	Mean (s)	SD (s)	Range (s)	Skewness	Evaluation
Girls 2000 m	34	718	142	411	+1.2	Non-normal, right-skewed
Boys 3000 m	47	544.6	84	332.8	+0.7	Approximately normal, slightly right-skewed

The results indicate that the data for girls deviate from normality, while the boys' data are approximately normal.

Table 3. Descriptive Statistics for Boys and Girls

Group	n	Mean (s)	Mean (min:s)	SD (s)	Range (s)	Skewness	Evaluation
Girls 2000 m	34	718	11:58	142	411	+1.2	Non-normal, right-skewed
Boys 3000 m	47	544.6	9:05	84	332.8	+0.7	Approximately normal, slightly right-skewed

The descriptive statistics illustrate performance patterns for both boys and girls. Due to the non-normal distribution of girls' data, percentiles were used instead of the mean $\pm$ standard deviation for performance classification. The boys' data, being approximately normal, were also evaluated using percentiles for consistency with the girls' classification.



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4-6-Steps for Constructing the Standardized Scale:

1. Arrange all values in ascending order for each group (boys and girls).
2. Determine percentiles: 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%.
3. Classify performance based on percentiles:
 - Excellent: top 10%
 - Very Good: 10–30%
 - Good: 30–50%
 - Average: 50–75%
 - Poor: bottom 25%

Table 4. Standardized Values for Girls

Level	Percentile	Time (s)	Time (min:s)
Excellent	10%	498	08:18
Very Good	20%	583	09:43
Good	30%	650	10:50
Good	40%	667	11:07
Average	50%	718	11:58
Average	60%	765	12:45
Average	70%	813	13:33
Poor	80%	876	14:36
Poor	90%	899	14:59

Table 5. Standardized Values for Boys

Level	Percentile	Time (s)	Time (min:s)
Excellent	10%	481	08:01
Very Good	20%	498	08:18
Good	30%	518	08:38
Good	40%	534	08:54
Average	50%	544	09:05
Average	60%	566	09:26
Average	70%	578	09:38
Poor	80%	599	09:59
Poor	90%	643	10:43

Interpretation of Tables 04 and 05:

The results indicate that girls' performance times exhibit high variability and a clear positive skew, reflecting non-normal distribution. Boys' data show a slight positive skew, approximating normal distribution. Accordingly, percentiles were adopted as a more accurate and fair method for constructing the standardized scale for both groups.

Table 6. Standardized Performance Scale for Girls

Standard Level	Percentiles	Time (min:s)
Excellent	$\leq 10\%$	$\leq 08:18$
Very Good	10–30%	08:19 – 10:50
Good	30–50%	10:51 – 11:58
Average	50–75%	11:59 – 13:33
Poor	$\geq 75\%$	$\geq 14:36$



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Table 7. Standardized Performance Scale for Boys

Standard Level	Percentiles	Time (min:s)
Excellent	$\leq 10\%$	$\leq 08:01$
Very Good	10–30%	08:02 – 08:38
Good	30–50%	08:39 – 09:05
Average	50–75%	09:06 – 09:38
Poor	$\geq 75\%$	$\geq 09:59$

Interpretation of Tables 06 and 07:

These standardized scales allow for the classification of students into clear performance levels based on actual school cross-country results. This approach enables objective evaluation of time performance, moving beyond simple ranking, and provides a practical tool for both educational assessment and early sports talent identification

5-Discussion

Following the presentation and analysis of the results through various statistical procedures, which included individual performance assessment and ranking, this study aimed to construct a standardized scale for time performance in school cross-country running among young adolescents. The objective was to enable objective evaluation of performance and to support sports talent identification in the school environment.

Descriptive statistics indicated a clear variation in time performance among participants, reflected in the relatively high standard deviation values, particularly among girls in the 2000 m race. This variability can be attributed to individual differences in biological maturity, physical condition, and motor experience. **(Tingelstad LM, 2025)** emphasized that adolescence is a critical developmental period. Since most age-group teams are organized by chronological age, understanding physical performance differences both between and within age categories is essential for



optimizing training strategies and selection processes according to team structures.

An important consideration in these processes is the influence of growth and maturation, which vary significantly between individuals and sexes during adolescence, affecting the timing and trajectory of physical development. Generally, the rate of improvement in physical performance during adolescence is slower and less pronounced in girls than in boys. This difference is largely explained by the greater increase in body fat in girls and the increase in muscle mass in boys during puberty (**Bezuglov, 2024**). Growth spurts in boys typically begin around ages 12–13 and last for approximately two years, which is closely linked to the established effects of endogenous testosterone on strength, speed, and endurance.

The results of the standardized scale revealed five distinct performance levels (Excellent, Very Good, Good, Average, Poor), allowing for practical classification of students beyond simple ranking. The data showed that only a small proportion of students fell within the Excellent and Very Good levels, while the majority were concentrated in the Average and Poor categories, indicating the need for targeted training programs to improve endurance capacities within this age group.

These findings align with previous studies on constructing standardized scales in running and endurance competitions, which confirmed that such scales provide an effective tool for evaluation and talent identification, particularly in educational contexts characterized by wide variability in student performance. Moreover, these results support the modern approach to sports measurement and evaluation, advocating a shift from raw performance-based assessment to standardized, comparable evaluation. (**Meloun, 2023**) highlighted that competition serves as a form of social evaluation. From this perspective, competition is not limited to comparing individuals against each other but also involves comparison against an objective standard of excellence. Precise measurements not only facilitate this evaluative aspect but also allow for assessing individual capabilities and progress toward specific goals. Athletics, being a quantitatively measurable sport, enables direct comparisons within competitions, but comparing performances across different competitions requires standardized scoring systems, which emerged in athletics in the late 19th century. (**Hoffmann, 2019**) emphasized that using normative percentile values assists in



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interpreting individual performance relative to a reference population. Standards can be applied to identify low-performing individuals requiring intervention, as well as high-performing individuals for talent identification and selection programs. Similarly, (Zeroual, 2013) reported that the establishment of performance standards enabled the identification of nine athletes, including four girls with high aerobic capacity, potentially guiding them toward endurance events. (mokrane, 2025) recommended adopting the defined standardized levels for evaluating player performance and selecting the highest-performing individuals.

6-Conclusion:

Based on both theoretical and field research, as well as statistical interpretation of the results, performance was classified into five standardized categories (Excellent, Very Good, Good, Average, Poor) using percentiles. The Excellent category represented a limited proportion of the sample, indicating that only a small number of girls possess high aerobic endurance at this age, with the majority concentrated in the Average and Poor categories, reflecting considerable variability in physical capacities.

For boys, the standardized scale results showed a more regular distribution compared to girls, with a relatively balanced progression across the five levels. A higher number of students were classified in the Good and Very Good categories, reflecting a relatively higher level of aerobic endurance.

7-Recommendations

- Regularly evaluate athletes to monitor physical development progress.
- Coaches should emphasize general endurance training, given its importance in developing other physical attributes.
- Implement comprehensive talent identification processes, considering all relevant aspects rather than focusing on a single factor.
- Develop standardized tables encompassing cross-country races in Algeria to establish a reliable reference base for educators, coaches, and sports specialists

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