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Classification Standards for Physical Fitness Indicators of Non-Specialist PE Students at Ho Chi Minh City University of Education: Statistical Basis and Practical Application

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Abstract:

In the context of contemporary higher education, evaluating students' physical fitness plays a pivotal role in enhancing educational quality and promoting holistic development. This study aims to establish a classification standard for the physical fitness indices of students at An Giang University, employing statistical methods (mean and standard deviation) across six indicators: 30m sprint, standing long jump, 4×10m shuttle run, 5-minute endurance run, trunk flexion, and sit-ups. Data were collected from 200 students at two time points—at the beginning of the academic year and after six months of training. The results reveal a significant improvement in the physical fitness indices following the training period, thereby affirming the feasibility and effectiveness of the proposed classification system. This framework provides a robust theoretical basis for the objective assessment of physical education.

Keywords: Physical Fitness; Classification; Statistical Analysis; Physical Education; University Students

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Introduction

Physical fitness is a cornerstone of holistic education, directly influencing students' academic performance, mental health, and long-term well-being (World Health Organization [WHO], 2020). In higher education, physical education (PE) programs aim to cultivate not only intellectual prowess but also physical resilience. However, the absence of standardized, objective criteria to classify and monitor students' fitness levels remains a critical gap. Current evaluation methods in many institutions rely on subjective assessments or outdated benchmarks, which fail to account for demographic variations, such as gender differences, or evolving fitness trends (Corbin et al., 2021). This inconsistency undermines the efficacy of PE programs and limits their ability to tailor interventions to individual

needs. Establishing statistically robust classification standards is thus imperative to enhance the precision of fitness evaluations, inform curriculum adjustments, and promote equitable health outcomes (Ortega et al., 2018).

The global shift toward sedentary lifestyles and rising obesity rates among young adults underscores the urgency of effective physical education frameworks (Guthold et al., 2018). In Vietnam, the Ministry of Education and Training mandates PE as a compulsory component of university curricula. However, institutions often lack localized, evidence-based criteria to assess student fitness, relying instead on generic guidelines that overlook physiological and gender-specific disparities (Nguyen et al., 2019). For instance, existing standards for endurance or agility may not reflect the unique fitness profiles of Vietnamese students, who exhibit distinct anthropometric and metabolic characteristics compared to Western populations (Trinh et al., 2020). Furthermore, the dynamic nature of physical fitness—shaped by factors like training duration and environmental conditions—necessitates longitudinal evaluations to capture progress accurately (Malina et al., 2015).

This study addresses the absence of a statistically validated classification system for non-specialist PE students at Ho Chi Minh City University of Education (HCMUE). Prior research in Vietnam has focused predominantly on elite athletes or children, leaving a void in university-level fitness assessment methodologies (Le & Dang, 2017). Existing tools, such as the National Physical Fitness Standards, lack granularity for age-specific cohorts and fail to incorporate modern statistical techniques like standard deviation-based categorization (Vietnam Ministry of Education, 1998). Consequently, educators struggle to identify at-risk students or measure the impact of training interventions objectively. This gap hinders the development of targeted PE programs and limits opportunities for evidence-based policy reform. By developing gender-specific benchmarks and leveraging longitudinal data, this research aims to bridge these shortcomings, offering a scalable model for other institutions.

This study employed a mixed-methods approach, combining quantitative surveys with statistical analysis, to establish fitness classification standards for 200 non-specialist students (100 males, 100 females) at HCMUE. Six fitness indicators were selected based on their objectivity, measurability, and alignment with prior literature (Caspersen et al., 1985): 30m sprint, standing long jump, 4×10m shuttle run, 5-minute endurance run, trunk flexion, and sit-ups. Data were collected at two intervals—baseline (beginning of the academic year) and post-training (after six months)—to evaluate progress.

Statistical methods, including mean (M) and standard deviation (SD), were used to categorize performance into five tiers: Excellent ($\geq M + 2SD$), Good ($M + SD$ to $< M + 2SD$), Average ($M - SD$ to $< M + SD$), Weak ($M - 2SD$ to $< M - SD$), and Poor ($< M - 2SD$). This approach ensured a base-based classification, minimizing subjective bias (Hopkins et al., 2009). For example, male students classified as "Excellent" in the 30m sprint required a time of $\leq$4.82 seconds at baseline, improving to $\leq$4.72 seconds post-training. Similarly, female students' standing long jump thresholds rose from $\geq$165.45 cm to $\geq$167.73 cm, reflecting enhanced lower-body strength.

Paired t-tests confirmed significant improvements ($p < 0.05$) across all metrics, validating the training program's efficacy. Gender-specific benchmarks were critical, as physiological differences necessitated distinct thresholds—a finding consistent with global studies (Thomas et al., 2020). For instance, male students exhibited higher baseline scores in explosive power (e.g., sprint times), while females demonstrated greater flexibility (trunk flexion). These disparities underscore the need for differentiated standards to ensure equitable assessment.

The study successfully established a replicable framework for fitness classification, demonstrating measurable improvements post-intervention. By integrating statistical rigor with practical applicability, this model provides educators with actionable insights to refine training regimens, allocate resources, and monitor student progress. The inclusion of longitudinal data also highlights the importance of sustained physical activity in achieving fitness goals—a finding aligned with the WHO's (2020) recommendations for regular exercise.

2. Materials and Methods

The study was carried out in accordance with scientific principles and a systematic experimental protocol, with the aim of developing objective and precise classification standards for students' physical-fitness indicators. Specifically, a quantitative survey approach combined with statistical analysis was employed, comprising the following steps:

Study Population and Sampling

The target population consisted of 200 undergraduates (100 male, 100 female) enrolled at Ho Chi Minh City University of Education. Participants were randomly selected from various classes. Data were collected at two time points: at the beginning of the academic year (baseline) and after six months of structured training. This sampling procedure ensured representativeness and accurately reflected the overall fitness level of the student body (Lê, Dương, & Nguyễn, 1991).

Selection of Fitness Indicators

Six fitness indicators were chosen based on objectivity, measurement precision, and theoretical grounding in the literature: 30 m sprint (standing start), standing long jump, 4×10 m shuttle run, 5-minute endurance run, trunk-flexion test, and sit-ups (repetitions in 30 s) (Caspersen et al., 1985).

Data Collection and Processing

All tests were administered according to national standards, using calibrated equipment under the supervision of qualified instructors (Đặng, 1995). Raw data were meticulously recorded and then processed in specialized statistical software to compute the mean (M) and standard deviation (SD) for each indicator (Đỗ & Huỳnh, 2008). Five classification levels ("Excellent," "Good," "Average," "Weak," "Poor") were defined by intervals of ± SD and ± 2 SD, enabling evaluation of differences over time and between genders.

Statistical Testing and Comparison

Inferential statistics, including paired t-tests, were applied to compare baseline and post-training results. This allowed the study not only to assess the efficacy of the physical-training program but also to quantify the magnitude of improvement in each fitness indicator (Dương, 1991).

3. Results

Development of Classification Standards for Ho Chi Minh City University of Education Students
We established a five-tier classification scheme for each fitness indicator, with point ranges assigned as follows:**Excellent**: 9–10 points; **Good**: 7–8 points; **Average**: 5–6 points; **Weak**: 3–4 points; **Poor**: 1–2 points.

Thresholds for these levels were determined based on the mean and standard deviation (SD) of each indicator: **Excellent**: ≥ M + 2 SD; **Good**: M + SD to < M + 2 SD; **Average**: M − SD to < M + SD; **Weak**: M − 2 SD to < M – SD; **Poor**: < M − 2 SD

At baseline, male students classified as "Excellent" in the 30 m sprint required ≤ 4.82 s, and in the standing long jump ≥ 180.26 cm. After six months of training, these thresholds improved to ≤ 4.72 s and ≥ 181.46 cm respectively, reflecting the positive impact of the program.

Table 1. Classification Standards for Physical Fitness Indicators of Male Students at Ho Chi Minh City University of Education (Beginning of Academic Year).

Classification	30 m Sprint (s)	Standing Long Jump (cm)	4×10 m Shuttle Run (s)	5-Minute Run (m)	Trunk Flexion (cm)	Sit-ups (reps/30 s)
Excellent	≤ 4.82	≥ 180.26	≤ 11.30	≥ 945.50	≥ 6.96	≥ 18.17
Good	4.83–5.19	175.80–180.25	11.31–11.75	922.78–945.49	6.50–6.95	17.60–18.16
Average	5.20–5.99	166.85–175.70	11.76–12.69	877.35–922.77	5.49–6.40	16.40–17.59
Weak	6.00–6.34	162.39–166.84	12.70–13.12	854.63–877.34	4.99–5.48	15.82–16.39
Poor	≥ 6.35	≤ 162.38	≥ 13.13	≤ 854.62	≤ 5.00	≤ 15.81

Table 2. Classification Standards for Physical-Fitness Indicators of Male Students at Ho Chi Minh City University of Education After Six Months of Training

Classification	30 m Sprint (s)	Standing Long Jump (cm)	4×10 m Shuttle Run (s)	5-Minute Endurance Run (m)	Trunk Flexion (cm)	Sit-ups (reps/30 s)
Excellent	≤ 4.72	≥ 181.46	≤ 11.13	≥ 952.35	≥ 7.34	≥ 20.04
Good	4.73–5.11	177.10–181.45	11.14–12.50	929.10–952.34	6.80–7.33	19.20–20.03
Average	5.12–5.89	168.26–177.09	11.60–12.51	882.65–929.09	5.75–6.79	17.37–19.19
Weak	5.90–6.26	163.87–168.25	11.61–12.98	859.42–882.64	5.23–5.74	16.49–17.36
Poor	≥ 6.27	≤ 163.86	≥ 12.99	≤ 859.41	≤ 5.22	≤ 16.48

Development of Classification Standards for Female Students

For female students, a similar pattern emerged (Tables 3 and 4). At baseline, the "Excellent" thresholds were set at ≤ 5.26 s for the 30 m sprint and ≥ 165.45 cm for the standing long jump. After six months of training, these improved to ≤ 5.09 s and ≥ 167.73 cm respectively, confirming the positive effect of the training program on female students' agility, endurance, and reaction capacity.

Table 3. Classification Standards for Physical-Fitness Indicators of Female Students at Ho Chi Minh City University of Education (Beginning of Academic Year)

Classification	30 m Sprint (s)	Standing Long Jump (cm)	4×10 m Shuttle Run (s)	5-Minute Endurance Run (m)	Trunk Flexion (cm)	Sit-ups (reps/30 s)
Excellent	≤ 5.26	≥ 165.45	≤ 11.98	≥ 824.89	≥ 7.91	≥ 14.08
Good	5.27–5.74	159.26–165.44	11.99–12.37	803.13–824.88	7.43–7.92	13.21–14.07
Average	5.75–6.70	146.88–159.25	12.38–13.17	759.64–803.12	6.45–7.42	11.49–13.20
Weak	6.71–7.17	140.70–146.87	13.18–13.55	737.88–759.63	5.98–6.44	10.63–11.48
Poor	≥ 7.18	≤ 140.69	≥ 13.56	≤ 737.87	≤ 5.97	≤ 10.62

Table 4. Classification Standards for Physical-Fitness Indicators of Female Students at Ho Chi Minh City University of Education After Six Months of Training.

Classification	30 m Sprint (s)	Standing Long Jump (cm)	4×10 m Shuttle Run (s)	5-Minute Endurance Run (m)	Trunk Flexion (cm)	Sit-ups (reps/30 s)
Excellent	≤ 5.09	≥ 167.73	≤ 11.87	≥ 832.46	≥ 8.16	≥ 14.08
Good	5.10–5.59	161.24–167.72	11.88–12.26	808.76–832.45	7.67–8.15	13.27–14.07
Average	5.60–6.58	148.26–161.23	12.27–13.04	761.39–808.75	6.71–7.66	11.63–13.26
Weak	6.59–7.06	141.78–148.25	13.05–13.42	737.69–761.38	6.23–6.70	10.83–11.62
Poor	≥ 7.07	≤ 141.77	≥ 13.43	≤ 737.68	≤ 6.22	≤ 10.82

Overall, the tabulated data demonstrate substantial improvements in both male and female students' fitness indicators after six months of training. These changes validate the feasibility of the proposed classification system and provide a solid evidence base for refining future physical-education curricula. Consequently, this study charts a new course for developing statistically grounded, practically applicable standards to support high-quality, comprehensive training programs in sport and exercise science.

4. Discussion

This research developed an objective evaluation framework for classifying university students' fitness based on concrete, measurable indicators and five predefined levels ("Excellent" to "Poor"). By applying mean ± SD calculations, the study enabled cross-group comparisons over time and between genders. The marked improvements observed between baseline and post-training measurements confirm the effectiveness of the implemented physical-education program.

Firstly, the five-tier structure offers a scientifically sound and logical grading scheme that not only identifies individual fitness levels but also facilitates comparisons across gender and temporal cohorts. Indicators such as the 30 m sprint, standing long jump, and 4×10 m shuttle run highlight gains in speed, endurance, and flexibility. These findings align with earlier studies by Dương Nghiệp Chí,(1991) and Lâm Tấn Văn,(2003), which emphasize the critical role of precise measurement in sports training and education.

Comparative analysis reveals significant gains across nearly all metrics—sprint times decreased and jump distances increased—demonstrating enhanced neuromuscular response and lower-limb power. This objectively substantiates the program's efficacy and echoes the Ministry of Education's call for objective, standardized fitness assessments (MoET, 1998).

Notably, gender-specific thresholds reflect inherent physiological differences: female students exhibited lower benchmarks for jump distance and sit-up repetitions, consistent with muscle-mass and anatomical variations documented by Nguyễn Hữu Châu ,(1998) and Ministry guidelines (MoET, 1995). Tailoring standards by gender ensures fairness and accuracy, supporting the design of targeted training regimens.

Moreover, the reliance on statistical and quantitative methods is a key strength. Using SD-based classification clarifies the distribution and variance of each indicator: "Excellent" performers exceed M + 2 SD, whereas "Poor" performers fall below M − 2 SD. This methodology, validated in multiple sports-measurement studies (Dang, 1995, Do & Huynh, 2008), enhances objectivity and reliability.

However, some limitations warrant attention. Statistical thresholds may be influenced by sample size and distribution characteristics; a small or non-homogeneous cohort could skew cut-off values, potentially misrepresenting the wider student population. Future research should expand sample sizes and incorporate qualitative assessments to complement quantitative data.

Environmental and procedural factors—such as weather conditions, equipment calibration, and instructor expertise—may also introduce measurement error. Hence, standard-setting should remain adaptive to local conditions and periodically recalibrated, as recommended by Lê Bửu et al. (1991) and Ministry reports (1995).

In summary, this study offers a robust, theory-driven, and practically viable classification framework. The measured improvements post-training and the delineation of gender-specific standards provide actionable insights for curriculum enhancement. Moving forward, the adoption of such evidence-based standards will elevate the quality of physical-education programs, foster student engagement in fitness activities, and lay a sustainable foundation for higher-education health initiatives.

5. Conclusion

This research established a five-level classification system for the physical-fitness indicators of Ho Chi Minh City University of Education students, grounded in mean ± SD statistical methodology. Data collected at baseline and after six months of training revealed significant improvements in all measured indicators—30 m sprint, standing long jump,

4×10 m shuttle run, 5-minute endurance run, trunk flexion, and sit-ups. The five-tier scale ("Excellent" to "Poor") offers an objective reflection of student fitness and tracks progress over time.

Comparisons between the two measurement points confirm the training program's effectiveness and underscore physiological differences between genders in threshold values. While the proposed system demonstrates high feasibility and practical utility, considerations of sample size and environmental factors suggest the need for further large-scale studies and controlled conditions to refine these standards.

Overall, this study provides a replicable, statistically rigorous model for fitness evaluation, with clear implications for enhancing physical-education curricula and promoting comprehensive student development in sport science.

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