DOI: 10.4025/jphyseduc.v36i1.3645

Original Article

THE EFFECTIVENESS OF PERSONALIZED PHYSICAL EDUCATION PROGRAMS ON FITNESS OUTCOMES IN FEMALE UNIVERSITY STUDENTS

EFICÁCIA DOS PROGRAMAS PERSONALIZADOS DE EDUCAÇÃO FÍSICA NOS RESULTADOS DE APTIDÃO FÍSICA DE ESTUDANTES UNIVERSITÁRIAS

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RESUMO

Introdução: Este estudo avalia um programa personalizado de Educação Física (EF) na Universidade de An Giang (AGU) - Vietnã, projetado para aprimorar as principais qualidades de aptidão física em alunas do primeiro ano. Métodos tradicionais de EF frequentemente desconsideram características individuais, limitando o desenvolvimento físico dos estudantes. O programa personalizado teve como objetivo abordar essas necessidades individuais, promovendo melhorias físicas direcionadas. Materiais e Métodos: Uma amostra de 300 alunas do primeiro ano foi dividida em grupos experimental (n=150) e controle (n=150). O grupo experimental seguiu um currículo de EF personalizado focado em suas principais características de aptidão, enquanto o grupo controle recebeu treinamento tradicional de EF. Avaliações físicas, incluindo força de preensão manual, teste de abdominais, salto em distância, corrida de velocidade, corrida de vaivém, resistência e flexibilidade, foram realizadas no início, no meio e no final do ano. Análises estatísticas foram realizadas para medir os avanços na aptidão física entre os grupos. Resultados: Após a intervenção, o grupo experimental apresentou melhorias significativas em todos os domínios de aptidão física em comparação ao grupo controle, notadamente na força de preensão manual (27,36%), repetições de abdominais (42,68%), salto em distância (19,13%) e flexibilidade (19,40%). Esses resultados confirmam a eficácia do programa em aprimorar tanto as capacidades aeróbicas quanto anaeróbicas. Conclusão: Os resultados indicam que programas personalizados de EF, adaptados às forças individuais de aptidão física, são eficazes na melhoria do desempenho físico e do engajamento em atividades físicas. As instituições devem considerar a implementação de modelos de EF personalizados para otimizar os resultados de saúde e motivação dos estudantes.

Palavras-chave: aprimoramento físico, adaptação individual ao treinamento, avaliação física, capacidade aeróbica e anaeróbica, resultados de saúde estudantil.

ABSTRACT

Introduction: This study evaluates a personalized physical education (PE) program at An Giang University (AGU)-Vietnam, designed to enhance dominant physical fitness qualities in first-year female students. Standard PE methods often overlook individual characteristics, limiting students' fitness development. This personalized program aimed to address these individual needs, fostering targeted physical improvements.Materials and Methods: A sample of 300 first-year female students was divided into experimental (n=150) and control (n=150) groups. The experimental group followed a tailored PE curriculum focused on their dominant fitness traits, while the control group received traditional PE training. Physical assessments, including grip strength, sit-up test, long jump, sprint, shuttle run, endurance, and flexibility, were conducted at baseline, mid-year, and year-end. Statistical analyses were performed to measure fitness improvements between groups.Results: Post-intervention, the experimental group showed significant enhancements in all fitness domains compared to the control group, notably in grip strength (27.36%), sit-up repetitions (42.68%), long jump (19.13%), and flexibility (19.40%). These outcomes support the program's effectiveness in advancing both aerobic and anaerobic capacities.Conclusion: The findings indicate that personalized PE programs tailored to individual fitness strengths are effective in improving physical performance and engagement in physical activity. Institutions should consider implementing personalized PE models to optimize student health outcomes and motivation.

Keywords: fitness enhancement, individual training adaptation, physical assessment, aerobic and anaerobic capacity, student health outcomes.

Introduction

The concepts of personalization and democratization in education, with a learner-centered focus, require careful consideration of individual characteristics in educational

approaches. In PE, the adoption of a personalized approach has become increasingly significant. The importance of this approach is underscored by the diversity in students' physical abilities and individual characteristics, which influence their responses to external factors and training loads[1]. Students possess varied levels of fitness, preferences, and intellectual and physical capacities, all of which affect their pace of material acquisition. Traditional PE methods and tools often fail to accommodate these individual characteristics, diminishing the positive health impact, inhibiting physical development, and reducing motivation in PE sessions. Adapting the PE curriculum to align with students' distinct physical and physiological characteristics allows for the selection of appropriate training means, supporting balanced motor skill development and personal growth[2,3]. The development of techniques that enhance individual strengths enables students to pursue self-improvement and express themselves uniquely. This personalized approach not only minimizes the risk of overload but also enhances health outcomes associated with physical training while aiding in mastering and advancing motor skills.

The demand for a personalized approach in education has been emphasized by leading scientists and educators. In PE, the personalized model groups students into homogeneous categories based on specific criteria[4,5]. In PE practice, experts recommend using fitness indices as a reliable basis for grouping students into similar categories. Fitness indices are generally regarded as more accurate than other indicators, with their informational value increasing with age. The methods for determining these indices are straightforward and standardized, making them suitable for application in student PE[6].

Numerous studies have compared training programs aimed at developing "strong" or "weak" fitness elements in sports such as rugby[7], wrestling[8], skiing[9], soccer[10], multisport events[11], and arm wrestling[12]. In most cases, experts question the effectiveness of training non-genetically-based fitness qualities. In swimming studies on 16-year-old adolescents, the effectiveness of phased training was demonstrated, with training for "strong" traits set at 40% and "weak" traits at 60% in the initial phase, and a ratio of 55% to 45% in the later phase[13].

Another method for improving PE in higher education is to incorporate non-traditional sports activities such as health walking[14], aerobic gymnastics[15,16], kickboxing, and aerobics[17]. Recently, researchers have focused on the effectiveness of sports-oriented PE programs, particularly those integrating information technology[18]. Students who participate in elective sports tend to show increased enthusiasm[19,20], greater activity involvement [21], and stronger volitional qualities[22]. Although students may not always aim for high athletic achievement, the development of inherent fitness qualities supports intrinsic motivation and satisfaction[23].

Research on personalized criteria in university-level PE, based on students' fitness levels, remains limited. To form homogeneous groups, experts recommend considering factors such as psychological indicators[24], nervous system characteristics[25], psychophysiological indicators[26], biomedical indices[27] (biological age), and physical health and pathology[28]. Both theoretical and experimental evidence demonstrate that a personalized approach in PE is significantly more effective than traditional methods, with tailored exercises expanding functional potential, improving functional and psychophysiological indices of students, and enhancing physical health. Physical abilities and fitness are also significantly elevated. Thus, a literature analysis indicates conflicting information regarding prioritizing the development of "strong" versus "weak" fitness qualities. Moreover, no specific guidelines exist for PE programs targeting untrained young adults. This lack of information increases the risk of overload and injury in PE sessions, potentially affecting adherence to fundamental educational principles and hindering educational integration with European standards. Clarifying the goal of prioritizing "strong" fitness qualities development in students will contribute to the effectiveness of PE programs in higher education.

Objective of the Study: This study was conducted to assess the effectiveness of a personalized PE program aimed at enhancing "strong" physical fitness qualities in first-year university students at AGU. The program was designed to adapt to the students' unique fitness levels, promoting the development of their dominant physical capacities.

To examine the impact of this personalized approach, 300 first-year female students were grouped into an experimental group (n=150) and a control group (n=150). The experimental group participated in tailored PE sessions focused on enhancing their "strong" fitness traits, while the control group received standard PE training. Fitness assessments were conducted at the beginning and end of each semester, and the data was analyzed to evaluate the program's overall effectiveness in promoting balanced fitness development in a higher education setting.

In this study, the tailored PE program was defined as a curriculum in which each session's exercises were selected and weighted according to each participant's pre‑identified dominant fitness qualities (e.g., strength, speed, agility, or endurance). By contrast, the traditional PE program provided all participants with an identical sequence of foundational drills—without weighting or individualization. For illustrative purposes, the tailored sessions combined 40% exercises targeting each student's primary strength with 60% addressing secondary qualities, whereas the traditional program uniformly allocated equal training volume (25% per domain) to all participants. A sample tailored session for a strength‑dominant individual included resistance exercises (e.g., isometric handgrip drills), plyometric jumps, and core stability work, whereas a traditional session comprised a fixed circuit of equal‑duration running, calisthenics, and flexibility drills.

Methods

Research Design and Sampling

This quasi‑experimental study employed a two‑group pretest‑posttest design. A total of 300 first‑year female students (mean age 18.38 ± 0.73 years) were recruited from An Giang University and randomly allocated to the experimental (n = 150) or control group (n = 150). Inclusion criteria were: female, first‑year enrollment, and absence of contraindicated health conditions. Randomization was stratified by baseline fitness level to ensure group homogeneity.

A sample of 300 first-year female students was selected to evaluate general physical fitness over the course of an academic year, following the PE program issued by the Director of VNU-HCM under Decision No. 1476/QĐ-ĐHQG dated November 27, 2020. Physical fitness assessments were conducted at two time points: the beginning of the first semester, the end of the first semester, and at the end of the second semester to monitor students' general fitness progression following the training period.

Research Organization: To determine the program's effectiveness, we conducted a pedagogical experiment. In the control group (n=150), all fitness qualities were trained equally. In the experimental group (n=150), as shown in Table 1, exercises were specifically directed towards developing the students' dominant (stronger) fitness qualities. During PE sessions, we employed light athletics methods, with exercises conducted on both indoor and outdoor sports grounds. At the start of the academic year (September), fitness tests were administered based on PE program standards to identify the most developed fitness qualities. Throughout the year (45 hours per semester), the main part of each session focused on exercises designed to enhance one of four fitness qualities: strength, speed, agility, or endurance.

Table 1. Participant Characteristics.

Group	Age (years)	Height (cm)	Weight (kg)
Experimental (n=150)	18.35 ± 0.77	159.12 ± 2.76	53.02 ± 2.25

Control (n=150)	18.41 ± 0.69	159.05 ± 2.87	53.13 ± 3.16

Source: The author.

This study adhered strictly to the ethical standards established in the 2008 Declaration of Helsinki. Ethical approval was granted by the Ethics Committee of AGU under Decision No. 1882/QĐ-ĐHAG. Prior to participation, all subjects provided informed consent voluntarily, ensuring adherence to ethical research practices.

Procedure: Before the commencement of the semester, participants completed a brief questionnaire to collect demographic data and details about their history of sports-related injuries. Individuals with significant health concerns were excluded; however, no exclusions were required based on the responses received.

Both the experimental and control groups participated in an initial fitness evaluation (baseline assessment) prior to starting their respective PE programs. These evaluations followed the fitness assessment standards outlined in Decision No. 53 (September 18, 2008) by the Vietnamese Ministry of Education and Training. To maintain reliability, the evaluation criteria were adjusted based on participants' age and gender, ensuring consistent and meaningful data collection[29,30,31,32].

Physical assessments measured the following fitness components and corresponding tests:

Muscular strength: dominant handgrip strength measured via dynamometer;
Muscular endurance: maximum sit‐up repetitions in 60 seconds;
Explosive power: standing long jump distance;
Speed: 30 m sprint time;
Agility: 4×10 m shuttle‐run time;
Cardiorespiratory endurance: distance covered in a 5-minute run;
Flexibility: sit‐and‐reach test (standing forward bend).

Each test followed standardized protocols (Decision No. 53/2008/QĐ-BGDĐT), with brief descriptions added to ensure reproducibility.

Statistical Analysis:

Statistical analyses were performed using SPSS software (version 20.0). Descriptive statistics, including mean and standard deviation, were calculated for continuous variables such as age, height, and weight. To validate the normality of the dataset, the Kolmogorov-Smirnov test was employed, confirming that the assumptions required for parametric testing were met[33].

The primary analysis aimed to compare fitness improvements within and between groups following the intervention. A paired sample t-test was applied to assess pre- and post-intervention differences within each group, providing insights into the effectiveness of the PE program. To evaluate intergroup differences in fitness improvements, an independent sample t-test was conducted, measuring statistical significance.

Furthermore, a two-way repeated measures ANOVA was utilized to examine the interaction effects of time (pre- and post-intervention) and group (experimental and control) on fitness outcomes. All analyses adopted a significance threshold of $p < 0.05$, and 95% confidence intervals were calculated to estimate the range of actual effects, thereby enhancing the precision and robustness of the findings.

Results

The primary outcome of this investigation was whether the personalized PE program would enhance overall fitness levels more effectively than traditional instruction. Our findings demonstrate that participants in the tailored curriculum experienced statistically significant and clinically meaningful improvements across all measured domains—strength, endurance, speed, agility, and flexibility—whereas the control group's gains were limited. These results confirm that individualized program design can substantially elevate student fitness outcomes within a single academic year.

The pre-experiment physical fitness assessment yielded no statistically significant differences between the experimental group (EG) and the control group (CG) across all measured variables, suggesting baseline homogeneity. For dominant hand grip strength, mean values were 25.56 kg for EG and 25.99 kg for CG, with a t-test result of $t=0.778$, $P>0.05$, indicating no initial disparity. Similarly, the sit-up test results demonstrated close mean values (EG: 17.71 reps; CG: 18.17 reps), with $t=0.903, P>0.05$.

In the standing long jump test, EG exhibited a mean jump distance of 152.43 cm compared to 150.94 cm in CG, yielding $t=1.73, P>0.05$, further confirming the similarity in baseline explosive strength. The 30m sprint times showed EG with a mean of 6.80 seconds and CG with 7.16 seconds ($t=1.03, P>0.05$), while shuttle run 4x10m times were closely aligned (EG: 13.61 sec; CG: 13.76 sec; $t=1.44, P>0.05$). For endurance (5-minute run), EG ran a mean distance of 863.43 m versus 860.14 m for CG, yielding no significant difference ($t=0.898, P>0.05$). Flexibility, as assessed by the standing forward bend, was also comparable, with means of 13.08 cm for EG and 13.43 cm for CG ($t=0.99, P>0.05$). These findings establish a balanced baseline across groups, enabling a reliable assessment of the intervention's impact. (See Table 2)

Table 2. Pre-Experiment Physical Fitness Results.

Test	(EG: N=150)		(CG: N=150)		t	P
	M	SD	M	SD		
Dominant hand grip strength (kg)	25.56	1.58	25.99	1.87	0.778	>0.05
Sit-up test (reps)	17.71	1.54	18.17	1.28	0.903	>0.05
Standing long jump (cm)	152.43	5.08	150.94	4.25	1.73	>0.05
30m sprint (sec)	6.80	0.71	7.16	0.51	1.03	>0.05
Shuttle run 4x10m (sec)	13.61	1.64	13.76	1.25	1.44	>0.05
5-minute endurance run (m)	863.43	65.72	860.14	66.65	0.898	>0.05
Standing forward bend (cm)	13.08	0.82	13.43	0.71	0.99	>0.05

Note: M = Mean; SD = Standard Deviation; t = t-test statistic; P = P-value (statistical significance).
Source: The author.

Post-experiment analysis revealed statistically significant improvements in the physical fitness metrics for the experimental group across all categories, indicating a substantial impact of the intervention. The dominant hand grip strength increased markedly in EG, with a mean of 33.66 kg (a 27.36% improvement), compared to a modest 9.56% increase in CG (28.6 kg); $t=24.75, P<0.001$. In the sit-up test, EG exhibited a 42.68% improvement (mean: 27.32 reps), whereas CG improved by only 15.95% (mean: 21.32 reps), with a highly significant difference ($t=22.04, P<0.001$).

For explosive strength as measured by the standing long jump, EG showed a remarkable increase of 19.13%, reaching a mean of 184.67 cm, compared to a 10.25% gain in CG (167.24 cm); t=15.64,P<0.001. The 30m sprint times of EG improved by 24.42%, resulting in a faster average of 5.32 seconds, while CG improved by 21.16% to an average of 5.79 seconds; t=10.42,P<0.001. The shuttle run 4x10m also demonstrated significant improvement, with EG's time decreasing by 12.49% to 12.01 seconds, surpassing the 10.56% reduction observed in CG (12.38 seconds); t=8.71,P<0.001.

Endurance, evaluated through the 5-minute run, saw a 7.09% increase in EG (926.86 m), which was significantly higher than the 5.32% gain in CG (907.13 m); t=5.04,P<0.001. Lastly, flexibility (standing forward bend) improved by 19.40% in EG (mean: 15.89 cm), contrasting with a decrease of 3.95% in CG (12.91 cm), presenting a compelling difference (t=11.32,P<0.001).

The results indicate that the experimental intervention elicited significant enhancements across all measured physical fitness parameters, while the control group displayed marginal improvements. This robust contrast underscores the effectiveness of the intervention, providing compelling evidence of its potential for elevating general fitness levels in similar student populations. Such findings not only validate the intervention's efficacy but also support its application as a model for targeted physical fitness improvement in academic settings. (See Table 3 and fig 1)

Table 3. Post-Experiment Physical Fitness Results.

Test	EG (N=150)			CG (N=150)			t	P
	M	SD	W%	M	SD	W%		
Dominant hand grip strength (kg)	33.66	0.69	27.36	28.6	1.27	9.56	24.75	<0.001
Sit-up test (reps)	27.32	1.41	42.68	21.32	1.4	15.95	22.04	<0.001
Standing long jump (cm)	184.67	4.95	19.13	167.24	4.94	10.25	15.64	<0.001
30m sprint (sec)	5.32	0.31	-24.42	5.79	0.46	-21.16	10.42	<0.001
Shuttle run 4x10m (sec)	12.01	1.05	-12.49	12.38	1.31	-10.56	8.71	<0.001
5-minute endurance run (m)	926.86	69.98	7.09	907.13	62.43	5.32	5.04	<0.001
Standing forward bend (cm)	15.89	0.26	19.40	12.91	0.62	-3.95	11.32	<0.001

Note: M = Mean; SD = Standard Deviation; W% = Percentage change in fitness; t = t-test statistic; P = P-value (statistical significance).
Source: The author.

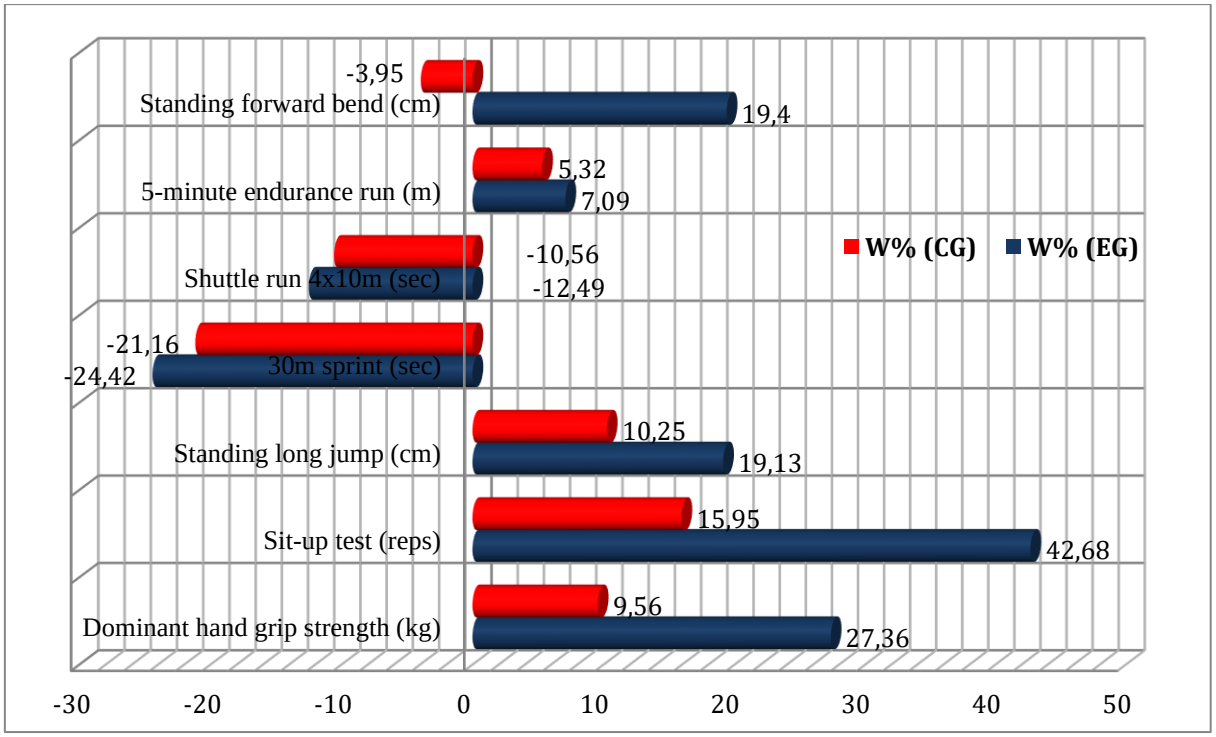

Figure 1: Comparative Analysis of W% Growth in Physical Fitness Tests Between Experimental and Control Groups.
Source: The author.

Discussion

The primary aim of this study was to evaluate the effectiveness of a personalized PE program implemented at AGU, with a focus on developing key physical fitness traits. This was assessed through a controlled experiment involving two groups of first-year female students, the EG and the CG. The findings demonstrate that the tailored program significantly enhanced physical fitness, especially in the experimental group, providing critical insights into the potential benefits of personalized PE approaches in higher education.

The results of the study align closely with the initial objectives of the research, which were to assess the effectiveness of a PE program that emphasizes the development of students' "strong" physical fitness traits. As hypothesized, the experimental group demonstrated substantial improvements across all fitness measures. Significant enhancements were observed in “dominant hand grip strength” (27.36% increase), “sit-up repetitions” (42.68% increase), “standing long jump distance” (19.13% increase), “30m sprint times” (24.42% improvement), and other fitness assessments. These results validate the approach of personalized training focused on individual strengths, as the EG significantly outperformed the CG in all categories, confirming that the personalized program met its goal of fostering superior fitness traits.

Recent studies have underscored the importance of tailoring PE programs to suit the individual needs and strengths of students, particularly in higher education[21,23]. As mentioned in the research, traditional PE methods often fail to address the diverse physical abilities and preferences of students, leading to suboptimal outcomes[1,33]. This study’s findings are consistent with those of previous research that highlighted the superior results achieved through personalized PE programs compared to standardized ones. For instance, recent work by Thi et al[2] and Thuc & Tan Phong[3] demonstrated that when training is adjusted to target students' specific strengths and weaknesses, it leads to more significant improvements in overall fitness

levels. Our findings further support this by showing that the personalized PE model led to marked improvements in fitness, making a strong case for its adoption in academic institutions.

One of the unique aspects of this study is the comprehensive improvement observed across all fitness metrics in the experimental group. While previous research has often focused on specific fitness traits like strength or endurance[2,3,34], this study highlighted holistic improvement in both aerobic and anaerobic capacities. The results also emphasize the importance of addressing the individual characteristics of students in the PE program. Notably, “flexibility” showed an extraordinary increase of 19.4% in the experimental group, contrasting with a decline in the control group. This finding suggests that personalized programs not only enhance strength and speed but also improve other crucial aspects of physical fitness, such as flexibility, which is often neglected in traditional PE curricula[35,36] .

Another distinctive aspect of the study is its contribution to the discussion of how personalized PE programs can foster intrinsic motivation among students. By focusing on individual strengths, students are more likely to experience a sense of accomplishment, which in turn may lead to increased engagement and long-term participation in physical activities.

If all results from this study are considered, the primary objective of evaluating the effectiveness of a personalized PE program aimed at developing "strong" fitness traits has been successfully met. The experimental group’s performance improvement across all fitness measures, compared to the control group, supports the hypothesis that a tailored approach can significantly enhance physical fitness levels in university students. Moreover, the research validates the concept of personalized fitness training, which emphasizes the development of individual strengths while addressing specific weaknesses.

Interestingly, the control group exhibited a slight decline in flexibility (–3.95%), despite modest gains in other fitness domains. We hypothesize that uniform, traditional PE instruction may have led participants to prioritize strength and endurance drills over stretching routines, thereby inadvertently neglecting flexibility maintenance. Additionally, the absence of systematic proprioceptive or mobility‐focused exercises likely contributed to this decrement. Future research should adopt a longitudinal design—extending beyond a single academic year—to ascertain whether flexibility deficits persist, recover, or even compound over time when tailored interventions are absent. Such extended monitoring will also shed light on the durability of program‐induced gains in other domains, informing best practices for sustained physical health in higher education settings.

Limitations

While this study demonstrates the positive impact of a personalized PE program on physical fitness in university students, certain limitations should be acknowledged. Firstly, the study was conducted with only first-year female students, which limits the generalizability of the findings to other student populations, including males and students from other academic years. Future studies should include a more diverse sample to assess whether the observed benefits extend across different demographics.

Secondly, the study focused exclusively on the short-term effects of the program within a single academic year. Consequently, the long-term impact of personalized PE programs on fitness levels and overall health remains unexamined. Longitudinal studies are necessary to determine the sustained effectiveness of personalized interventions over multiple years and to assess their influence on lifelong health habits.

Additionally, although various fitness qualities were assessed, the program's impact on other dimensions of well-being, such as mental health and academic performance, was not examined. Considering these additional factors could provide a more comprehensive understanding of the holistic benefits of personalized PE programs.

Recommendations

Implementation of Personalized Programs: Based on the findings, it is recommended that universities adopt personalized PE programs, particularly for students in their first year. Such programs should be designed to assess and target individual strengths and weaknesses, with tailored exercises aimed at improving specific fitness traits.

Focus on Diverse Fitness Metrics

While strength and speed are often prioritized in traditional PE programs, the improvements seen in flexibility and endurance in this study suggest that future programs should aim for a more balanced development of all fitness components, ensuring holistic physical development.

Engagement and Motivation

The study highlights the motivational benefits of personalized training. Therefore, it is advisable to integrate motivational strategies, such as tracking individual progress and providing feedback, to enhance student engagement in physical education activities.

Further Research

Although the findings are promising, further research is needed to examine the long-term effects of personalized PE programs on students' health and fitness. Longitudinal studies could provide more insight into how sustained personalized interventions influence overall health outcomes in the student population.

In conclusion, this study presents strong evidence for the effectiveness of personalized PE programs in improving physical fitness levels in university students. The approach not only fosters superior physical traits but also enhances students' motivation and engagement, making it a valuable model for future educational settings.

Conclusion

This study provides compelling evidence of the effectiveness of a personalized PE program tailored to the individual fitness strengths of first-year female students. The results indicate significant improvements in physical fitness, particularly in flexibility, strength, speed, and endurance, within the experimental group. The personalized approach not only enhanced specific physical fitness qualities but also minimized the risk of overload, showing promise as a model for PE programs aimed at balanced fitness development.

These findings underscore the potential of personalized PE programs to improve student engagement and motivation in physical activity by fostering a sense of accomplishment and catering to individual needs. The study further validates the personalization of PE as a valuable strategy for achieving targeted fitness outcomes and promoting health in higher education settings.

To enhance external validity, it should be noted that our personalized PE framework is readily adaptable to diverse educational contexts. By employing baseline fitness profiling and modular exercise modules, institutions can replicate the tailored curriculum with minimal logistical overhead. We therefore recommend that future implementations explicitly document local adaptations—such as facility constraints or cultural preferences—to facilitate cross‐setting comparisons and to validate the transferability of our model across varied academic populations.

Contributions of authors

The article was prepared, written, and corrected by Dao Chanh Thuc. The last iteration of the article was author-by-writer. On the presentation's sequence, writers were in agreement.

Ethical endorsement

All procedures conducted in this research adhered to the principles outlined in the 1964 Helsinki Declaration and its subsequent revisions, or equivalent ethical standards, along with meeting the ethical guidelines set forth by the institutional and/or national research committee.

Competing interests

The author affirms that there are no conflicts of interest that may be taken to prevent this paper from being published.

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Acknowledgements: This research is funded by An Giang University (AGU), Vietnam National University Ho Chi Minh City (VNU-HCM), under grant number 24.01.TC." The authors express their sincere gratitude to all participants for their invaluable contributions of time and effort to this research endeavor. They also gratefully acknowledge the essential support and expertise provided by their colleagues at AGU-VNU-HCM, which proved instrumental to the study's successful completion.

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Editor: Carlos Herold Junior
Received on Feb 04, 2025.
Reviewed on June 26, 2024.
Accepted on June 27, 2024.

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