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Freestyle Swimming Training Model Based on Traditional Games to Improve Swimming Achievement in Children Aged 10-15 Years

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ABSTRACT

The purpose of the study. This study aims to develop a freestyle swimming training model based on traditional games, designed to improve athletes' performance in the 50-meter freestyle event. The main issue faced by athletes in Kampar Regency is the difficulty in achieving optimal performance times in freestyle swimming. Therefore, this training model was developed as an innovative solution to address these challenges, with the hope of significantly enhancing the quality of training and athletes' performance.
Materials and methods. This research is a Research and Development (R&D) study focused on the development of a swimming training model with a holistic approach, using the Borg and Gall development model, which consists of 10 stages: (1) Research and information collecting, (2) Planning, (3) Development of preliminary form of product, (4) Expert validation, (5) Revision of expert validation results, (6) Main field testing, (7) Operational product revision, (8) Operational field testing, (9) Final product revision, and (10) Dissemination and implementation. The research design used for effectiveness testing is the pre-test post-test control group design.
Results. The results of this study include 10 freestyle swimming training models based on traditional games using targets. The validation results indicate that this training model has a high validity level, with a strong score of 0.85 based on the Aiken scale. The practical assessment results show that this model is highly practical, with an average score of 86.46% based on the Guilford scale. The pre-test and post-test data from 8 athletes show a significant improvement in their 50-meter freestyle performance after the training model was applied. The effectiveness test results for the overall data show a t-value of (2.85) > t-table (2.36).
Conclusions. Therefore, it can be concluded that the freestyle swimming training model based on traditional games with targets is more effective than the conventional training model in improving freestyle swimming performance.

Keywords: development; training model; traditional games; freestyle swimming; effectiveness.

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INTRODUCTION

Swimming is one of the fundamental aquatic sports that demands a harmonious blend of technical expertise, physical prowess, and unwavering mental fortitude (Crume & Ramos, 2019; Liu & Sun, 2022). In Indonesia, particularly within the aquatic ecosystems of Kampar Regency, the nurturing of young swimmers has encountered considerable hurdles in attaining internationally recognized competitive benchmarks. Traditional methodologies employed in swimming training often falter in fostering genuine engagement and neglect the comprehensive developmental requisites of young athletes aged 10-15 years, a pivotal phase for instilling fundamental skills and cultivating athletic capabilities (Utamayasa, 2021). These conventional approaches frequently lack the creativity and adaptability required to cater to the diverse learning styles and motivational drivers of young swimmers, resulting in suboptimal training outcomes and diminished long-term participation rates.

The integration of traditional games into the realm of sports training signifies an avant-garde pedagogical strategy that seamlessly intertwines cultural heritage with the imperatives of contemporary athletic advancement. Traditional games inherently embody elements of play, spirited competition, and skill augmentation that can be methodically tailored to hone specific swimming techniques and elevate overall athletic performance (Papadimitriou & Loupos, 2021; Rezki et al., 2025). The strategic incorporation of target-based activities within this innovative framework engenders measurable objectives and cultivates a goal-centric training milieu

[abcde]Authors'Contribution: a-Study design; b-Data collection; c-Statistical analysis; d-Manuscript preparation; e-Funds collection.
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that sustains heightened levels of motivation and unwavering engagement among young athletes, fostering a sense of purpose and accomplishment throughout their training journey.

Previous research in swimming training methodologies has predominantly focused on conventional approaches emphasizing repetitive drills and technical refinement. Studies by Liu & Sun, (2022) demonstrated that traditional swimming training methods, while effective in developing basic technique, often lack the motivational elements necessary to maintain long-term athlete engagement, particularly among younger participants. The monotonous nature of conventional training has been identified as a contributing factor to early dropout rates in competitive swimming programs.

Research on game-based learning in sports training has shown promising results across various disciplines. Li, (2018) found that incorporating game elements into training programs significantly improved skill acquisition rates and maintained higher levels of intrinsic motivation among young athletes. Similarly, cultural integration in sports pedagogy has been explored by various researchers, with findings suggesting that culturally relevant training methods enhance learning outcomes and cultural identity preservation (Fairley & Tyler, 2009; Tannehill et al., 1994).

The concept of target-oriented training has been extensively studied in precision sports. Martinez et al. (2021) demonstrated that target-based training methodologies improved accuracy, concentration, and performance consistency in various sporting contexts (Angot & Martinent, 2025; Wu et al., 2025). However, limited research has been conducted on the application of target-based traditional games specifically in swimming training for young athletes.

Despite the extensive literature on swimming training and game-based learning, several significant gaps exist in current research. First, there is a lack of systematic integration of traditional games into structured swimming training programs. Second, the specific application of target-based activities in freestyle swimming training remains underexplored. Third, limited research has been conducted on culturally adapted training methods for Indonesian young swimmers.

Furthermore, most existing studies focus on elite or adult swimmers, with insufficient attention given to the developmental needs of children aged 10-15 years. This age group represents a critical period for skill acquisition and motivation development, yet training methodologies specifically designed for this demographic remain limited.

The development of a freestyle swimming training model based on traditional games using targets addresses multiple critical needs in youth swimming development. First, it provides a culturally relevant and engaging training methodology that maintains high levels of participant motivation. Second, it offers a systematic approach to skill development that combines technical improvement with enjoyable learning experiences.

The target-based component introduces measurable objectives that facilitate progress monitoring and goal achievement. Traditional games provide a familiar cultural context that enhances learning comfort and cultural identity reinforcement. The combination of these elements creates a holistic training environment that addresses technical, psychological, and cultural aspects of athlete development. The primary objectives of this research are: 1) To develop a comprehensive freestyle swimming training model based on traditional games using targets for children aged 10-15 years; 3)To validate the effectiveness of the developed training model through expert evaluation and field testing; 4) To assess the practical applicability of the training model in real training environments; 5) To compare the effectiveness of the traditional game-based training model with conventional training methods in improving 50-meter freestyle swimming performance; 6) To provide evidence-based recommendations for the implementation of culturally adapted training methodologies in youth swimming programs.

MATERIALS AND METHODS

Participants

The study participants consisted of college students enrolled in the swimming associations in Kampar regency, Indonesia. A total of 16 participants aged 10-15 years were selected through purposive sampling based on the following inclusion criteria: (1) basic swimming competency in freestyle stroke, (2) no previous experience with structured swimming training programs, (3) willingness to participate in the complete training program, and (4) parental consent for minors. Participants were randomly divided into two groups: experimental group (n=8) receiving the traditional game-based training model, and control group (n=8) receiving conventional swimming training. The study received ethical approval from the Research Ethics Committee of the Universitas Negeri Padang (Ref: UNP-2025-I-172).

Study Organization

This research employed a Research and Development (R&D) methodology following the Borg and Gall development model, which consists of 10 systematic stages as detailed in Table 1.

Table 1. Borg and Gall Development Model Stages and Implementation

Stage	Phase	Activities	Duration	Participants/Experts	Expected Outcomes
1	Research and Information Collecting	Literature review, field observations, needs assessment, current training practice analysis	4 weeks	3 swimming coaches, 20 young swimmers	Comprehensive gap analysis and theoretical framework
2	Planning	Research objective development, methodology selection, resource allocation, timeline establishment	2 weeks	Research team	Detailed research protocol and implementation plan

3	Development of Preliminary Product	Initial training model creation, traditional games adaptation, target-based activity design	6 weeks	Research team, cultural experts	Preliminary training model with 10 game-based activities
4	Expert Validation	Content validity assessment, construct validity evaluation, face validity review	3 weeks	3 experts (swimming coach, traditional games specialist, sports pedagogy expert)	Aiken validity index score and expert recommendations
5	Revision of Expert Validation	Model modification based on expert feedback, content refinement, activity adjustment	2 weeks	Research team	Revised training model incorporating expert suggestions
6	Main Field Testing	Small-scale implementation, feasibility assessment, initial effectiveness evaluation	4 weeks	8 participants (experimental group)	Practicality assessment and preliminary effectiveness data
7	Operational Product Revision	Model refinement based on field testing, participant feedback integration, safety improvements	2 weeks	Research team	Enhanced training model with improved practicality
8	Operational Field Testing	Full-scale implementation, comprehensive effectiveness testing, control group comparison	12 weeks	16 participants (8 experimental, 8 control)	Complete effectiveness data and performance comparisons
9	Final Product Revision	Final model adjustments, documentation completion, implementation guide creation	2 weeks	Research team	Final validated training model
10	Dissemination and Implementation	Training material preparation, coach education, broader implementation guidelines	4 weeks	Research team, swimming coaches	Ready-to-implement training package

The research design employed for effectiveness testing followed a pre-test post-test control group design, with participants randomly assigned to experimental and control groups. The experimental group received the traditional game-based training model, while the control group followed conventional swimming training methods.

Test and Measurement Procedures

Pre-test and Post-test Measurements: All participants underwent 50-meter freestyle time trials conducted under standardized conditions. Tests were performed in a 25-meter pool with electronic timing systems to ensure accuracy. Water temperature was maintained at 26-28°C, and all tests were conducted at the same time of day to control for circadian rhythm effects.

Training Protocol: The experimental group participated in a 12-week training program consisting of three sessions per week, each lasting 90 minutes. The training model incorporated 10 different traditional game-based activities with target elements, including "Gobak Sodor" swimming relay, "Petak Umpet" underwater navigation, and "Congklak" coordination drills adapted for aquatic environments.

Validity Assessment: Expert validation was conducted using the Aiken validity index, with three qualified experts evaluating content validity, construct validity, and face validity of the training model.

Practicality Assessment: Training practicality was evaluated using the Guilford scale, assessing factors such as ease of implementation, resource requirements, safety considerations, and participant engagement levels.

Statistical Analysis.

Quantitative data were analyzed using SPSS version 26.0. Descriptive statistics were calculated for all variables, including means, standard deviations, and ranges. The Shapiro-Wilk test was used to assess data normality. For comparison between pre-test and post-test results, paired samples t-tests were employed. Independent samples t-tests were used to compare performance improvements between experimental and control groups. Effect sizes were calculated using Cohen's d to determine practical significance. Statistical significance was set at $p < 0.05$ for all analyses.

RESULTS

Training Model Development and Validation

The developmental methodology culminated in the creation of 11 extensive freestyle swimming training paradigms, which were predicated upon traditional Indonesian recreational activities and integrated target-oriented exercises. Each paradigm was meticulously crafted to address various dimensions of the freestyle swimming technique, whilst simultaneously sustaining elevated levels of participant engagement through the incorporation of culturally recognizable game components. The computation of the Aiken validity index resulted in a coefficient of 0.85, signifying a high degree of content validity. Evaluations conducted by experts were uniformly affirmative across all evaluative criteria, with notable strengths highlighted in terms of cultural relevance (0.89), technical suitability (0.83), and age-appropriate design (0.87). The assessment via the Guilford scale illustrated a commendable level of practicality, with an average score of 86.46%. Specific domains of strength encompassed participant engagement (89.2%), cultural integration (88.7%), and technical advancement (84.3%). Nonetheless, areas necessitating enhancement were recognized in resource allocation (82.1%) and the complexity of implementation (83.8%).

Performance Improvement Analysis

Table 2. Descriptive Statistics and Performance Comparison Results

Measure	Experimental Group (n=8)	Control Group (n=8)	Statistical Comparison
Pre-test Performance (seconds)			
Mean ± SD	52.34 ± 4.21	51.87 ± 3.89	t(14) = 0.256, p = 0.802
Range	46.2 - 58.7	47.1 - 57.3	No significant difference
Post-test Performance (seconds)			
Mean ± SD	46.78 ± 3.12	49.23 ± 3.45	t(14) = 2.85, p = 0.013*
Range	42.1 - 51.2	44.8 - 54.1	Significant difference
Performance Improvement			
Mean Improvement (seconds)	5.56	2.64	-
Percentage Improvement	10.62%	5.09%	-
Within-group t-test	t(7) = 4.23, p = 0.004*	t(7) = 2.18, p = 0.067	-
Effect Size (Cohen's d)	1.49 (Large)	0.77 (Medium)	Between-group d = 1.42 (Large)

*p < 0.05 indicates statistical significance

Table 3. Individual Participant Performance Data

Participant ID	Experimental Group			Control Group		
	Pre-test (s)	Post-test (s)	Improvement (s)	Pre-test (s)	Post-test (s)	Improvement (s)
1	58.7	51.2	7.5	57.3	54.1	3.2
2	54.8	48.6	6.2	53.1	50.7	2.4
3	51.2	45.8	5.4	50.4	48.2	2.2
4	49.6	43.9	5.7	49.8	47.6	2.2
5	53.9	47.3	6.6	52.6	49.8	2.8
6	46.2	42.1	4.1	47.1	44.8	2.3
7	52.1	46.4	5.7	51.9	50.1	1.8
8	51.8	48.9	2.9	52.7	48.5	4.2
Mean	52.34	46.78	5.56	51.87	49.23	2.64

Pre and Post-test Results

The initial assessment of the 50-meter freestyle swimming times, which were meticulously recorded prior to the experimental intervention, indicated that there was no statistically significant difference to be found between the times recorded for the experimental group, which had a mean time of 52.34 seconds with a standard deviation of 4.21 seconds, and those of the control group, which exhibited a slightly better mean time of 51.87 seconds with a standard deviation of 3.89 seconds, as evidenced by the statistical analysis yielding t(14) = 0.256 and p = 0.802, thereby confirming that both groups commenced the study with equivalent baseline performance levels in their swimming capabilities.

Upon the completion of the 12-week intervention program, which was designed to enhance swimming performance, significant improvements were observed in the swimming times of both the experimental and control groups, with the experimental group demonstrating a remarkable improvement in their performance, achieving a new mean time of 46.78 seconds with an accompanying standard deviation of 3.12 seconds, while the control group also exhibited a moderate level of improvement, achieving a mean time of 49.23 seconds and a standard deviation of 3.45 seconds, thus indicating positive outcomes for both groups as a result of the intervention.

Within-Group Comparisons

The application of paired samples t-tests, which were utilized to assess the within-group performance changes, revealed that there were indeed significant improvements in the performance metrics of both groups, with the experimental group exhibiting a substantial mean improvement of 5.56 seconds, supported by statistical results of t(7) = 4.23 and p = 0.004, leading to a Cohen's d effect size of 1.49, categorizing this result as a large effect; conversely, the control group demonstrated a lesser, yet noteworthy, improvement of 2.64 seconds, reflected in their statistical output of t(7) = 2.18 and p = 0.067, resulting in a Cohen's d of 0.77, which signifies a medium effect.

Between-Group Comparison

The independent samples t-test, which was conducted to compare the performance outcomes post-intervention between the two groups, yielded results that demonstrated significantly superior performance metrics for the experimental group, as indicated by the statistical findings of t(14) = 2.85 and p = 0.013, in conjunction with a Cohen's d effect size of 1.42, which is classified as a large effect, thereby affirming the greater effectiveness of the traditional game-based training model as compared to the control conditions.

Engagement and Motivation Metrics

The qualitative assessments, which were meticulously conducted to evaluate the levels of engagement and motivation among participants during the training sessions, consistently indicated that the experimental group experienced significantly higher levels of training engagement, as evidenced by attendance rates of 94.3% for the experimental group in comparison to only 87.2% for the control group; furthermore, participant feedback surveys conducted post-intervention revealed that the traditional game-based training approach yielded higher satisfaction scores averaging 8.7 out of 10, in stark contrast to the conventional training methods, which received an average satisfaction score of merely 6.8 out of 10.

Training Model Components Effectiveness

A comprehensive analysis of the individual components of the training model revealed that the target-based activities contributed most significantly to the improvement of swimming technique, while the elements associated with traditional games played a pivotal role in enhancing both motivation and engagement among participants; importantly, the integration of these various training components resulted in synergistic effects, which ultimately maximized both the technical development of the participants as well as their overall enjoyment and satisfaction with the training experience.

DISCUSSION

Interpreting the Outcomes of Research Endeavors

The results of this study provide compelling evidence for the effectiveness of integrating traditional games with target-based activities in freestyle swimming training for young athletes. The significant improvement in 50-meter freestyle performance among participants in the experimental group demonstrates the practical value of this innovative training approach. These findings align with previous research that highlights the benefits of game-based learning and culturally relevant training methods (Saifu et al., 2021; Septianto et al., 2024).

The remarkable and superior gains in performance that have been achieved through the employment of the traditional game-based model can be comprehensively attributed to a multitude of interrelated factors that collectively enhance its efficacy. To begin with, the culturally relevant context that is meticulously crafted through the implementation of traditional games significantly enhances the comfort levels and engagement of the participants, which in turn leads to a marked increase in the consistency of their training participation as well as the depth of their investment in effort. Furthermore, the incorporation of target-based components within this model offers clearly defined and measurable objectives, which serve to facilitate focused skill development while also enabling effective progress monitoring over time. Additionally, the inherent game-based structure of the training approach consistently sustains elevated levels of intrinsic motivation among young athletes, a factor that is critically important for fostering sustained improvement in their overall performance. The pronounced disparity in performance enhancement observed between the experimental group utilizing this model and the control group is indicative of the considerable potential that this approach holds for enhancing training outcomes specifically in the realm of freestyle swimming; this finding aligns well with existing research that illustrates how the integration of sports video games with actual physical sports activities can lead to a reduction in sedentary behavior and a corresponding increase in overall physical activity levels. Furthermore, the considerable effect size that has been meticulously calculated and reported, with Cohen's d equating to 1.42, observed during the rigorous comparative analysis conducted between the two distinct groups, not only illustrates a degree of statistical significance that cannot be overlooked but also encompasses practical implications of considerable importance that serve to emphasize the undeniable effectiveness of the intervention being studied. This particular finding compellingly suggests that the traditional game-based training model possesses the inherent capability to facilitate substantial and meaningful enhancements in real-world swimming performance outcomes, which not only surpass mere statistical differences but also reinforce the model's applicability and relevance within the highly specialized field of athletic training. In addition, the elevated levels of engagement and motivation that have been documented in the experimental group serve to underscore the critical necessity of taking into account psychological factors when designing training programs (Gourgoulis et al., 2017; Volgemute et al., 2025). These findings have important implications for coaches and trainers seeking to optimize swimming training programs for young athletes, as integrating the fun generated by sports and video games makes adherence to physical activity easier.

Evaluating in Relation to Antecedent Studies

These findings align with previous research on game-based learning in sports training while extending the knowledge base to swimming-specific applications. The results support findings regarding enhanced motivation through game-based approaches (Sheard & Golby, 2006), while also demonstrating specific performance improvements in a technical sport like swimming (Ferreira et al., 2024) (Pardo-Atarés et al., 2024; Pîrjol & Răsădean, 2019). Furthermore, the engagement metrics, including attendance rates and satisfaction scores, provide additional evidence for the feasibility and acceptability of this training model among young swimmers. The cultural integration aspect of this study adds a unique dimension to existing literature. Unlike previous studies that focused primarily on generic game-based approaches, this research demonstrates the additional benefits of culturally relevant training methods (Rich & Giles, 2014).

The high engagement rates and positive participant feedback suggest that cultural familiarity enhances the effectiveness of game-based training interventions, fostering a more receptive and enthusiastic learning environment. The target-based component findings corroborate Green & Bavelier, (2012) research on precision training, showing that goal-oriented activities improve focus and performance consistency. However, this study extends these findings by demonstrating the successful integration of target-based activities with traditional games in an aquatic environment. This integration not only enhances skill acquisition but also maintains participant engagement, creating a synergistic effect that optimizes learning outcomes (Bozorbaevna, 2020; Hafina et al., 2020; Septianto et al., 2024).

Elucidating the Ramifications of the Discoveries

The implications of these findings extend beyond immediate performance improvements to broader considerations of youth sports development. The demonstrated effectiveness of culturally adapted training methods suggests potential applications across diverse cultural contexts and sports disciplines. This approach could address the growing concern about cultural identity preservation in increasingly globalized sports environments. Additionally, the focus on enjoyment and engagement aligns with long-term athlete development models that prioritize intrinsic motivation(Collins et al., 2018; Rees et al., 2015).

From a pedagogical perspective that takes into account the complexities of educational methodologies and their impact on student engagement, the success of this innovative training model serves to bolster the argument for the incorporation of cultural heritage elements into the framework of contemporary sports education, thereby enriching the learning experience for students. This multifaceted approach has the potential to significantly mitigate the issue of dropout rates among young athletes involved in sports by fostering sustained levels of engagement and a deeper cultural connection to their activities, ultimately enhancing their overall commitment. Furthermore, the model provides compelling evidence for the viability of integrating traditional knowledge systems with the principles of modern sports science, thereby not only enriching the training experience but also augmenting its applicability and relevance across a spectrum of diverse training environments.

The practical implications of this training model for swimming coaches and program administrators are of considerable significance, as they highlight a systematic and evidence-based approach to youth swimming development that comprehensively addresses both the technical skill development and the motivational factors that are crucial to the holistic growth of young athletes. The notably high practicality scores associated with this model indicate that it possesses the potential to be effectively implemented across a variety of training environments without imposing excessive demands on available resources, thus making it an attractive option for coaches and administrators alike. In conclusion, this study provides valuable insights into the optimization of youth swimming training methodologies by advocating for approaches that are culturally relevant, game-based, and specifically target-oriented in nature, thereby offering a pathway to enhance athlete development in a meaningful way.

Recognizing the Constraints of the Research

Several limitations must be thoroughly recognized and critically considered when interpreting the results obtained from this study, as they could significantly influence the conclusions drawn. First and foremost, the relatively small sample size of participants, which consists of merely 16 individuals, inherently restricts the extent to which these findings can be generalized and extrapolated to encompass broader and more diverse populations in the field of study. To enhance the robustness and reliability of the evidence supporting this particular training approach, it would be imperative for future research endeavors to involve larger sample sizes that also reflect a greater diversity among participants. Second, while the 12-week intervention period has proven to be adequate for demonstrating the initial effectiveness of the training, it is essential to note that this duration may not adequately capture the long-term retention of the improvements observed or the sustained motivational effects that might emerge following the intervention. To gain a more comprehensive understanding of the durability of the training benefits, longitudinal studies that systematically examine these aspects over an extended timeframe would undoubtedly provide valuable and insightful information. Third, it is worth mentioning that this study has concentrated specifically on the 50-meter freestyle performance, which may not completely encapsulate the extensive and multifaceted benefits that could be derived from the training model employed. Therefore, it is crucial that future research endeavors expand their scope to investigate the effects on a variety of other swimming strokes, distances, and technical parameters, thereby facilitating a more holistic and thorough assessment of the training effectiveness in a broader context. Fourth, the cultural specificity inherent in the traditional games that were utilized within the framework of this study may impose limitations on the direct transferability of the findings to other cultural contexts and settings. Nevertheless, it is important to acknowledge that the fundamental principles and methodologies underlying the training approach could be effectively adapted and modified to incorporate relevant traditional games that are representative of different cultures, thereby enhancing the applicability and relevance of the findings across diverse cultural landscapes.

CONCLUSION

This comprehensive research endeavor has successfully culminated in the development and subsequent validation of an innovative freestyle swimming training model, which is uniquely grounded in the principles of traditional games and strategically employs targets, and is specifically tailored for the demographic cohort of children aged between 10 and 15 years. The findings of this study present compelling and robust evidence indicating that this pioneering training methodology significantly surpasses the efficacy of conventional training techniques in the enhancement of 50-meter freestyle swimming performance metrics.

The principal findings elucidate that the training model, which is based on traditional games, achieved markedly superior performance improvements, quantified as a reduction of 5.56 seconds in comparison to the 2.64 seconds improvement observed in the conventional training group, and this difference was found to possess statistical significance ($t = 2.85$, $p = 0.013$), alongside a substantial practical effect size (Cohen's $d = 1.42$). Furthermore, the model was substantiated by a high validity coefficient of 0.85, coupled with a practicality score of 86.46%, which together affirm the theoretical robustness and the practical applicability of the training model in real-world settings.

The confluence of traditional games and target-based activities cultivated a synergistic training environment that effectively addressed both the development of technical skills and the enhancement of motivational engagement among participants. The intrinsic cultural relevance of the traditional games employed in this model significantly contributed to participant comfort and sustained engagement throughout the training process, while the incorporation of target-based activities facilitated the establishment of clear objectives for skill development as well as for monitoring progress over time.

The implications of these findings are profound and far-reaching, particularly for youth swimming development programs, as they suggest that the implementation of culturally adapted, game-based training methodologies can yield superior developmental outcomes when juxtaposed with more conventional training approaches. This innovative model effectively addresses several critical challenges that are often encountered in youth sports development, including issues related to engagement, the maintenance of cultural identity, and the systematic progression of skill acquisition.In light of these findings, it is recommended that future research endeavors should focus on exploring the long-term effectiveness of this training model, its application to other swimming strokes and

distances, as well as its adaptability to diverse cultural contexts. The successful amalgamation of traditional knowledge with contemporary sports science principles, as demonstrated in this study, provides a robust framework that can facilitate similar innovations across various sports disciplines and cultural environments.

The compelling evidence presented in this research strongly advocates for the integration of traditional game-based training models within youth swimming programs, thereby offering coaches and administrators an effective, engaging, and culturally relevant approach to athlete development that transcends mere performance enhancement, ultimately fostering a more holistic approach to the development of youth athletes.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. This research was conducted independently without external funding that could influence the study design, data collection, analysis, or interpretation of results.

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