FROM SOCIAL VULNERABILITY TO NATIONAL-LEVEL PERFORMANCE: A CASE STUDY ON THE DEVELOPMENT OF A JUNIOR SWIMMER IN THE 200 M BUTTERFLY EVENT

Cătălin PĂUNESCU[1*], Silviu PETRESCU[1], Ion MIHĂILĂ[2], Oana PETRESCU[1], Teodor PĂUNESCU[3], Gabriel PIȚIGOI[1]

[1] *University of Medicine and Pharmacy "Carol Davila", Bucharest, Romania*

[2] *National University of Science and Technology Politehnica Bucharest, University Center Pitești, Romania*

[3] *National Physical Education and Sport University, Bucharest, Romania*

Corresponding author: e-mail: catalinpaunescu@umfcd.ro

https://doi.org/10.52846/47.2026.1.1

Abstract

Background: The present study investigates the effectiveness of a structured selection and training model applied to youth from socially vulnerable environments, by analyzing the progression of a junior swimmer (16 years old) from recreational practice to national-level performance in the 200 m butterfly event. *Methods:* A longitudinal case study design was implemented over 16 weeks within the "Chance for Performance" project. From an initial cohort of 36 participants without stable familial support, six were selected based on anthropometric and functional indicators. The subject (V.D.) followed a structured program consisting of four weekly training sessions, aiming to meet national qualification standards.

Results: Following the intervention, the athlete achieved a time of 2:09.82 in the final of the National Championships (Junior I), securing third place. This performance was 13.3% (19.93 seconds) faster than the qualification standard (2:29.75). Performance stability between heats and final (Δ = 0.44 s) suggests effective physiological adaptation. *Conclusions:* The findings indicate that socioeconomic vulnerability does not inherently limit athletic potential when access to structured training and systematic evaluation is provided. The proposed model supports the inclusion of underrepresented populations in talent identification systems.

Keywords: *talent identification, swimming, social vulnerability, butterfly stroke, resilience*

Introduction

Identifying and developing sporting talent represents a complex, multifactorial process shaped by the interaction between genetic predispositions and environmental conditions (Vaeyens et al., 2008; Johnston et al., 2018). Developmental pathways are not uniform, and differences between elite and non-elite athletes are often associated with variations in training exposure, timing of specialization, and access to structured environments (Güllich, 2017). However, access to structured training environments remains uneven, with socioeconomic status acting as a significant constraint on participation and progression (Bailey et al., 2010; Collins et al., 2016).

In Romania, recreational sport participation among youth reflects structural limitations in access and continuity, highlighting the need for targeted support mechanisms that facilitate transition toward systematic training (Mihaela et al., 2013). This transition becomes particularly relevant during adolescence, a period marked by identity restructuring and increased sensitivity to environmental influences (Petrescu et al., 2019; Holt et al., 2017).

From a performance perspective, swimming—particularly the 200 m butterfly event—requires a complex integration of aerobic capacity, anaerobic tolerance, and technical efficiency (Olbrecht, 2015). The identification of suitable athletes therefore depends on multidimensional assessment models capable of capturing both morphological and functional indicators (Păunescu et al., 2013). These processes are further influenced by long-term developmental pathways and training exposure, as highlighted in comprehensive analyses of elite athlete development models (Rees et al., 2016).

At the same time, literature suggests that exposure to adverse environments may contribute to the development of psychological resilience, which can be leveraged in high-performance sport contexts (Collins & Macnamara, 2012; Sarkar & Fletcher, 2014). Nevertheless, systemic inequities often lead to the underrepresentation of such

individuals within formal talent pathways (Post et al., 2017).
The present case study, developed within the "Chance for Performance" project, examines whether a structured 16-week intervention can facilitate the transition from latent potential to validated national-level performance in a junior swimmer (16 years old) originating from a socially vulnerable background.

Materials and Methods
The study employed a longitudinal case study design, focusing on the progression of a single subject (V.D., 16 years old) from recreational swimming to national-level competition.
The participant was selected from an initial group of 36 children (aged 8–16) in social protection systems. Selection criteria included anthropometric measurements (e.g., wingspan, body proportions), functional indicators, and motor performance testing using the Myotest Pro device, benchmarked against age-matched competitive swimmers.
The intervention lasted 16 weeks and consisted of four weekly training sessions (90 minutes each), conducted in a controlled aquatic environment. The program emphasized aerobic conditioning, stroke mechanics, and race-specific adaptation for the 200 m butterfly event.
Performance outcomes were measured through official electronic timing systems in accredited competitions and compared against national qualification standards established by the Romanian Swimming Federation.
All participants were enrolled voluntarily, with informed consent obtained from legal guardians. The study adhered to the Declaration of Helsinki and received approval from the institutional ethics committee.

Results
The intervention resulted in a marked improvement in performance.
The subject achieved a time of 2:10.26 in the heats and 2:09.82 in the final, securing third place at the National Championships (Junior I category).
The improvement relative to the qualification standard (2:29.75) was 19.93 seconds (13.3%).

Table 1. Summary of the selection process and performance progression indicators

Analysis Parameter	**Indicator / Cohort**	**Observed Values**	**Percentage / Significance**
Selection base	Initial cohort (screening)	N = 36	100%
Specific selection	Participants admitted to the program	N = 6	16.6% (biometric retention rate)
FRNPM validation	Athletes qualified (national standards)	N = 2	33.3% (training effectiveness)
Normative threshold	Qualification standard (200 m butterfly)	02:29.75	Federal reference standard
Preliminary performance	Time achieved in heats (V.D.)	02:10.26	$\Delta = -19.49$ s vs. standard
Final performance	Time achieved in final (V.D.)	02:09.82	3rd place – National Championships

* *Δ represents the difference in time relative to the qualification standard.*

As shown in Table 1, the selection process demonstrated a high degree of specificity, with only 2 out of 36 participants reaching national qualification standards.

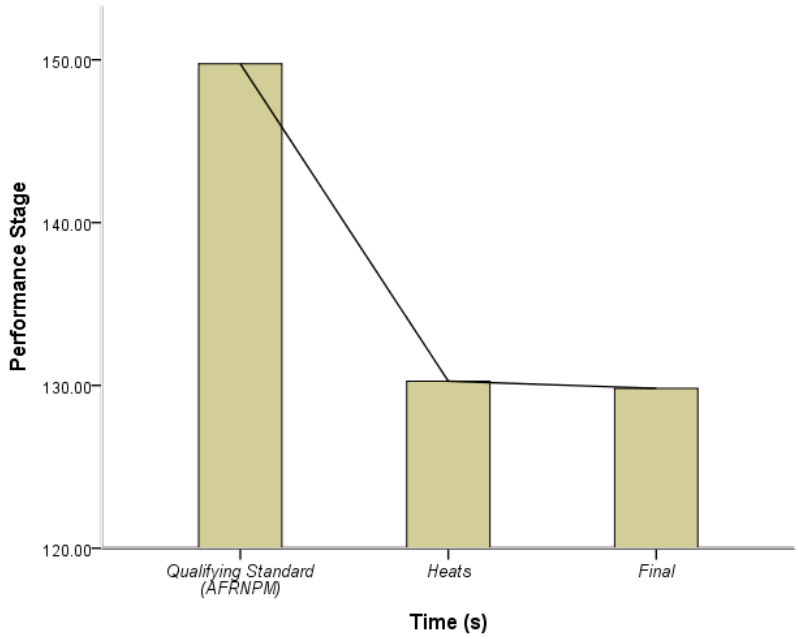

Figure 1. Comparative analysis of performance times relative to the national qualification standard

The figure shows the relationship between the national qualification standard and the athlete's performance across competitive rounds. A substantial reduction in race time is observed, with a 13.3% improvement already evident in the heats. The minimal variation between heats and final (Δ = 0.44 s) indicates stable performance across rounds.

Discussion

The performance progression observed over the 16-week intervention exceeds the improvements typically reported in junior swimming within comparable timeframes. While rapid gains can occur during early stages of structured training, the magnitude of change recorded in this case suggests a favorable interaction between individual predispositions and the training environment.

Performance in the 200 m butterfly is strongly associated with a high glycolytic contribution, efficient energy distribution, and technical consistency under fatigue (Olbrecht, 2015). The ability of the athlete to maintain performance between heats and final within a minimal time variation (Δ = 0.44 s) indicates a stable physiological response across competitive rounds. Such stability is generally linked to effective pacing strategies and adequate recovery capacity during competition. The magnitude of performance improvement observed in this case should also be interpreted in relation to athlete classification frameworks, which emphasize the importance of contextualizing performance level and training status (McKay et al., 2021).

From a developmental perspective, the findings support the notion that access to structured training environments plays a decisive role in the expression of athletic potential (Abbott & Collins, 2004). Previous research has emphasized that talent identification systems may overlook individuals from disadvantaged backgrounds due to limited access to organized sport (Bailey et al., 2010; Collins et al., 2016). The present case provides empirical support for the inclusion of alternative recruitment pathways targeting underrepresented populations.

The role of psychosocial factors should also be considered, although not directly measured in this study. Existing literature suggests that exposure to adversity may contribute to the development of adaptive resilience mechanisms (Masten, 2021; Sarkar & Fletcher, 2014). However, such interpretations remain speculative and should be addressed in future research using appropriate psychological assessments.

The primary limitation of this study is its single-case design, which restricts generalizability. Nevertheless, its exploratory value lies in documenting the early-stage emergence of performance in a context rarely captured in the literature, where most studies focus on already established athletes. Future research should investigate larger cohorts and integrate physiological and psychological profiling to

better understand the mechanisms underlying rapid performance development.

Conclusion

The present case study demonstrates that a structured training intervention can facilitate a rapid transition from recreational participation to national-level performance in a junior swimmer originating from a socially vulnerable background.

The observed improvement, achieved within a 16-week period, supports the effectiveness of selection models based on anthropometric and functional indicators when combined with consistent training exposure. The results suggest that performance potential may remain unexpressed in the absence of access to appropriate training environments, rather than being inherently limited by socioeconomic conditions.

Although the findings are limited by the single-case design, they provide practical support for the development of inclusive talent identification strategies aimed at expanding the recruitment base of competitive sport.

Future research should explore larger samples and integrate physiological and psychological profiling to better understand the mechanisms underlying rapid performance development in similar contexts.

Acknowledgments

This study was conducted within the framework of the project "Chance for Performance: Identifying swimming talent among children without parental support" (Ș.V.S: 01/29.12.2025), part of the "Equal Opportunities through Sport" program, supported by Zarman Logistic and The Vilia Events.

The funding bodies provided financial support only and had no involvement in the study design, data collection, analysis, interpretation of data, or manuscript preparation.

The authors declare no conflict of interest.

References

Abbott, A., & Collins, D. (2004). Eliminating the dichotomy between theory and practice in talent identification and development: considering the role of psychology. *Journal of Sports Sciences*, *22*(5), 395-408. https://doi.org/10.1080/02640410410001675324

Bailey, R., Ford, P., MacNamara, A., & Pearce, G. (2010). *Participant development in sport: An academic review* (Vol. 4, pp. 1-134). Leeds: Sports Coach UK.

Collins, D., & Macnamara, Á. (2012). The rocky road to the top: why talent needs trauma. *Sports Medicine*, *42*(11), 907-914. https://doi.org/10.1007/BF03262302

Collins, D. J., Macnamara, A., & McCarthy, N. (2016). Putting the bumps in the rocky road: Optimizing the pathway to excellence. Frontiers in psychology, 7, 1482. https://doi.org/10.3389/fpsyg.2016.01482

Güllich, A. (2017). International medallists' and non-medallists' developmental sport activities–a matched-pairs analysis. *Journal of Sports Sciences*, *35*(23), 2281-2288. https://doi.org/10.1080/02640414.2016.1265662

Holt, N. L., Neely, K. C., Slater, L. G., Camiré, M., Côté, J., Fraser-Thomas, J. & Tamminen, K. A. (2017). A grounded theory of positive youth development through sport based on results from a qualitative meta-study. *International Review of Sport and Exercise Psychology*, *10*(1), 1-49. https://doi.org/10.1080/1750984X.2016.1180704

Johnston, K., Wattie, N., Schorer, J., & Baker, J. (2018). Talent identification in sport: a systematic review. *Sports Medicine*, *48*(1), 97-109. https://doi.org/10.1007/s40279-017-0803-2

Masten, A. S. (2021). Resilience of children in disasters: A multisystem perspective. *International Journal of Psychology*, *56*(1), 1-11. https://doi.org/10.1002/ijop.12737

McKay, A. K., Stellingwerff, T., Smith, E. S., Martin, D. T., Mujika, I., Goosey-Tolfrey, V. L., ... & Burke, L. M. (2021). Defining training and performance caliber: a participant classification framework. *International Journal of Sports Physiology and Performance*, *17*(2), 317-331. https://doi.org/10.1123/ijspp.2021-0451

Mihaela, P., Gabriela, G., Marinescu, G., Cătălin, P., & Gabriel, P. (2013). Relational aspects of leisure and recreational sport among young people in Romania. *Procedia-Social and Behavioral Sciences*, 84, 925-928. https://doi.org/10.1016/j.sbspro.2013.06.675

Olbrecht, J. (2015). *The science of winning: planning, periodizing and optimizing swim training*. F&G Partners.

Păunescu, C., Gagea, G., Păunescu, M., Piţigoi, G., & Petrescu, S. (2013). Concept and procedure for measuring anaerobic motricity in Taekwondo. *Applied Mechanics and Materials*, 436, 265-270. https://doi.org/10.4028/www.scientific.net/AMM.436.265

Petrescu, O., Păunescu, C., Petrescu, S., Pitigoi, G., & Mircica, M. L. (2019). Identity and adolescence. A perspective on scientific studies. *Journal of Sports and Kinetic Movement, 34*(2), 5-19.

Post, E. G., Bell, D. R., Trigsted, S. M., Pfaller, A. Y., Hetzel, S. J., Brooks, M. A., & McGuine, T. A. (2017). Association of competition volume, club sports, and sport specialization with sex and lower extremity injury history in high school athletes. *Sports Health*, *9*(6), 518-523 . https://doi.org/10.1177/1941738117714

Rees, T., Hardy, L., Güllich, A., Abernethy, B., Côté, J., Woodman, T., ... & Warr, C. (2016). The great British medalists project: a review of current knowledge on the development of the world's best sporting talent. *Sports Medicine*, *46*(8), 1041-1058. https://doi.org/10.1007/s40279-016-0476-2

Sarkar, M., & Fletcher, D. (2014). Psychological resilience in sport performers: a review of stressors and protective factors. *Journal of Sports Sciences*, *32*(15), 1419-1434. https://doi.org/10.1080/02640414.2014.901551

Vaeyens, R., Lenoir, M., Williams, A. M., & Philippaerts, R. M. (2008). Talent identification and development programmes in sport: current models and future directions. *Sports Medicine*, *38*(9), 703-714. https://doi.org/10.2165/00007256-200838090-00001