International Journal of Pedagogics

VOLUME Vol.06 Issue01 2026
PAGE NO. 156-163
DOI 10.37547/ijp/Volume06Issue01-34

Pedagogical Potential Of The Author-Developed ARVETS Cycling Program In The System Of Physical Education

Horkusha Andrii
President of the American Center for Sport Excellence & Research Inc., Sacramento, USA

Received: 25 November 2025; **Accepted:** 17 December 2025; **Published:** 21 January 2026

Abstract: The current development of physical education requires rethinking traditional approaches to organizing motor activity. This shift emphasizes pedagogically oriented, adaptive, and cognitively enriched forms of learning. Conventional training approaches primarily focus on physical indicators and overlook the educational potential of endurance. The purpose of this study is to substantiate the pedagogical potential of the author-developed ARVETS cycling program in physical education.

The study employed an analytical-empirical design. Research methods included structural-functional pedagogical analysis, pedagogical interpretation, questionnaire survey, and qualitative data synthesis. The participants were 20 professional cyclists with prior experience in prolonged ARVETS-based training sessions. Survey results confirmed the realization of the pedagogical potential of the ARVETS program. Increased self-regulation was reported by 85% of participants. Enhanced cognitive endurance was indicated by 88% of respondents. Improved motor awareness was noted by 90% of participants. Additionally, 84% confirmed the possibility of pedagogical transfer of ARVETS into the physical education system. The findings indicate that ARVETS can be considered an innovative pedagogical system of physical education. Scientific novelty lies in the pedagogical substantiation of integrating physical and cognitive endurance components. Further research should examine the program in educational groups of different ages and preparedness levels.

Keywords: Physical education; endurance training; pedagogical potential; self-regulation; cognitive endurance; motor awareness.

Introduction: The contemporary physical education system is undergoing transformation from normative physiological models toward pedagogically oriented motor learning approaches. Current research increasingly focuses on the active learner role, self-regulation development, cognitive engagement, and conscious attitudes toward physical activity. In this context, endurance is viewed not only as a physical capacity but as a multidimensional educational characteristic.

This characteristic integrates physiological, cognitive, and behavioral components within physical education. Despite extensive endurance research, most existing approaches emphasize sport-oriented outcomes and performance indicators. The pedagogical potential of endurance for developing autonomy, responsibility, and conscious motor activity remains insufficiently explored. This issue is particularly relevant for physical education, which requires adaptive models integrating educational and health-related objectives. In this context, author-developed programs integrating physical and cognitive components within a unified educational process gain special attention. One such program is ARVETS, designed to combine rhythmically variable load, motor self-regulation, and cognitive activity during prolonged tasks. Unlike traditional approaches, ARVETS targets not only physical endurance development but also educationally significant learner qualities. The pedagogical analysis of ARVETS is driven by the need to examine its structure, didactic logic, and integration potential within physical education.

LITERATURE REVIEW

Recent research underscores the value of combining physical and cognitive training in PE. For example, André et al. (2025) describe "Brain Endurance Training" (BET) that integrates mentally fatiguing tasks into exercise, consistently improving athletes' endurance by targeting executive functions. In a controlled trial, Staiano et al. (2022) similarly found that football players who added cognitive tasks after workouts markedly outperformed controls on endurance, agility, and cognitive tests. Daneshgar-Pironneau et al. (2025) reported that trained endurance athletes maintained task effectiveness even under mental fatigue, suggesting that endurance-based activity supports cognitive resilience. These findings are particularly relevant for physical education, where similar mechanisms may be intentionally developed through pedagogically structured endurance tasks.

In school PE, cognitively rich pedagogy yields similar benefits. Zha et al. (2025) implemented Cognitive Activation Teaching Strategies (CATS) in PE, using goal-setting, progressive challenges, and feedback to create "productive struggle." They found CATS significantly boosted students' engagement, self-efficacy, and physical performance. In parallel, mindfulness training enhanced athletes' endurance and executive function in Nien et al.'s (2020) study: meditators ran longer and made fewer Stroop errors than controls. Thus, cognitive exercises can transfer to physical outcomes. However, Dallaway et al. (2023) caution that cognitive tasks alone are ineffective: in their trials, mentally fatiguing training by itself did not improve endurance. In summary, authors converge on the benefit of dual-task approaches, but disagree on sufficiency; specifically, they imply that without simultaneous physical challenge, cognitive drills have little effect. This highlights the novelty of programs that adaptively blend both components.

A related theme is motor awareness and self-regulation. Scholars argue PE should develop students' body-awareness and autonomy, not just deliver exercise. González-Calvo et al. (2022) contend that PE should holistically "generate motor awareness" rather than focus narrowly on obesity. They emphasize fostering autonomy through self-regulation so students learn how, when, and where to be active in ways that fit their needs. Valle-Muñoz et al. (2025) further show that pedagogical models like Physical Literacy use feedback and self-assessment to heighten students' awareness of their motor skills, which in turn boosts motivation and sustained participation. Foundational reviews support this: Kolovelonis and Goudas (2013) describe a four-phase model where learners progress from observation to self-regulated practice of skills. These perspectives agree that metacognitive strategies (planning, monitoring, adjusting one's movement) are crucial in PE. A gap, however, is that most evidence is theoretical or secondary; few empirical studies demonstrate how to systematically train motor metacognition or adaptive pacing in regular PE classes.

In synthesis, the literature agrees that embedding cognitive challenges into physical education enhances both mental and physical outcomes. Disagreements emerge regarding the scope of effects. Zha et al. (2025) found that CATS significantly increased self-efficacy and in-class performance but did not affect emotional regulation. In contrast, Dallaway et al. (2023) caution that cognitive tasks alone are insufficient to develop endurance. Crucially, most studies have been short-term or lab-based (often with athletes), leaving unaddressed how to design adaptive, long-term curricula. In particular, no prior research has tested a fully integrated, adjustable endurance curriculum in PE. The ARVETS cycling program is novel in this regard. It blends adaptive load management with cognitive tasks and self-regulatory instruction in a school setting, directly addressing the identified gaps. Despite growing evidence on cognitive–physical synergy, there remains a lack of empirically grounded models that conceptualize endurance training as a pedagogical system within physical education rather than as a sport-oriented intervention.

METHODS

Study Procedure. The study employed an analytical-empirical design aimed at identifying the pedagogical potential of the author-developed ARVETS cycling program in physical education. The research was conducted through several interconnected stages.

At the first stage, results from a prior empirical study were considered. In that study, the ARVETS program was piloted with professional cyclists during prolonged cycling sessions exceeding three hours. The prior study provided empirical data on physiological, neuromuscular, and cognitive aspects of program

functioning. These data were used in the present study as a scientific basis for subsequent pedagogical analysis.

At the second stage, a structural-functional pedagogical analysis of the ARVETS program was conducted. The analysis was based on the author-developed methodological description and the technical training protocol of the program. These materials included session phase organization, adaptive load regulation mechanisms, and integration of cognitive stimuli into motor activity. The program was examined not from physiological effectiveness perspectives but as a pedagogical model of motor learning.

At the third stage, a pedagogical questionnaire survey of participants was conducted. The survey aimed to identify educational effects related to self-regulation, cognitive endurance, motor awareness, and pedagogical transfer into physical education.

Research Methods. The study applied a set of complementary research methods. Structural-functional pedagogical analysis was employed to identify the didactic logic of the ARVETS program, including its phased structure, learning tasks, and feedback mechanisms. This analysis enabled evaluation of ARVETS as an integrated pedagogical system. An analytical method of pedagogical interpretation was used to interpret program components through contemporary physical education, self-regulation, and learner-centered learning concepts. A questionnaire survey assessed participants' perceptions of pedagogical effects. The author-developed questionnaire included Self-regulation, Cognitive endurance, Motor awareness, and Transferability sections. Qualitative response synthesis was applied to thematically group short open-ended participant comments, supporting interpretation of quantitative results.

Study Sample. The study involved 20 male professional cyclists who had previously participated in an empirical evaluation of the ARVETS program. This sample was purposively selected because all participants had direct experience with prolonged ARVETS-based training, enabling a well-grounded assessment of its pedagogical effects.

Selection criteria included at least five years of systematic cycling training, regular participation in sessions exceeding three hours, and absence of injuries during the study period. The use of a homogeneous sample ensured internal consistency of the results and enhanced the validity of the pedagogical generalizations.

Research Instruments and Materials. The study materials included the author-developed scientific and methodological description of the ARVETS program, its technical training protocol, empirical data from prior program validation, and participants' questionnaire responses. The program's novelty is supported by the submission of a patent application to the United States Patent and Trademark Office (USPTO), confirming the originality of its structure and mechanisms.

The structural analysis was based on the ARVETS technical description, which specifies phase-based session organization, adaptive load regulation mechanisms, and integration of cognitive stimuli into motor activity. The detailed program protocol was examined not in terms of physiological efficiency but as a pedagogical model of learning-oriented motor activity.

RESULTS

The study results demonstrated that the author-developed ARVETS cycling program can be considered not only a training tool but an integrated pedagogical system aligned with fundamental didactic principles of physical education. The program has a clearly structured, stage-based logic that includes sequential preparatory, main, and concluding phases, each fulfilling a distinct educational function.

A key feature of ARVETS is the integration of physical and cognitive tasks within a single training-learning process. This integration creates conditions for active learner participation, continuous feedback, and independent action adjustment. The program architecture corresponds to the principles of progression, activity, and conscious motor engagement, allowing ARVETS to be regarded as a potentially effective model within the physical education system.

Analysis of participant survey results in the Self-regulation block revealed a pronounced pedagogical effect in developing self-control and self-regulation skills. Most respondents (85%) reported that during

ARVETS sessions they actively managed their own effort rather than mechanically performing prescribed tasks.

The ability to consciously regulate pace and workload during prolonged sessions was confirmed by 80% of participants, indicating the formation of conscious motor regulation skills. The highest indicator concerned responsible awareness of one's functional state: 90% of participants noted that the program enhanced their ability to recognize fatigue signals and adjust behavior accordingly.

From a pedagogical perspective, these findings indicate the development of learner autonomy. Within ARVETS, participants act not as passive instruction followers but as active learners who make decisions, assess their own condition, and take responsibility for the learning process (Figure 1).

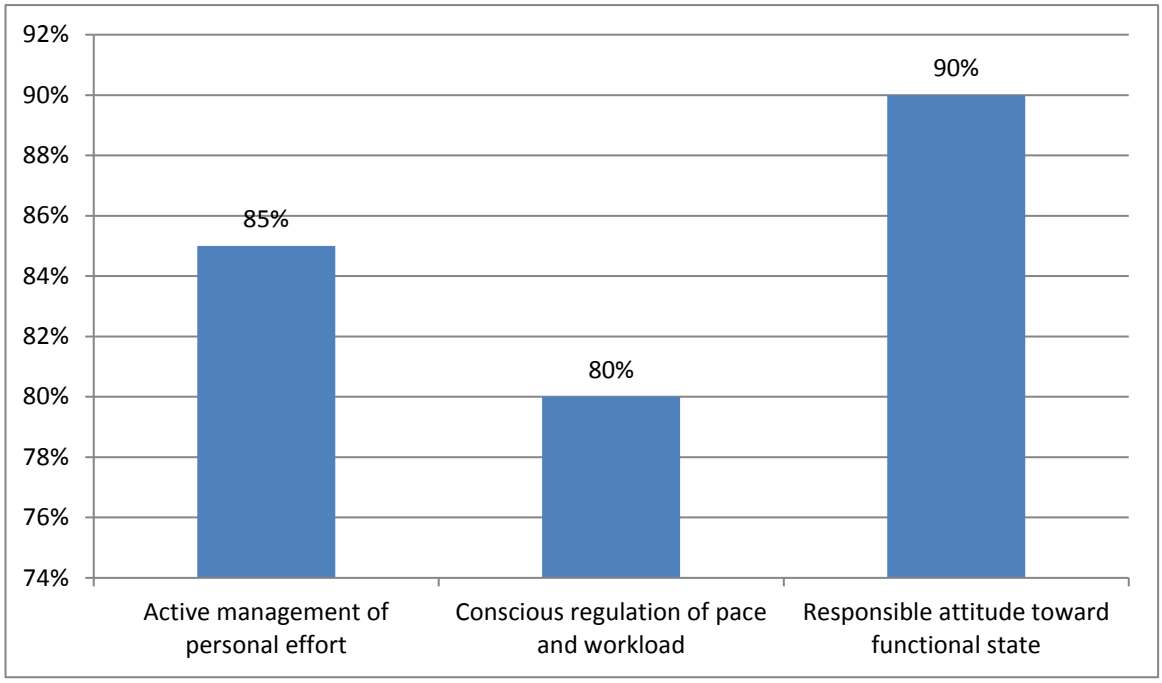

Fig. 1. Indicators of pedagogical self-regulation among participants of the ARVETS program (% positive responses)

Source: Developed by the author

The survey results in the Cognitive endurance block showed that ARVETS develops not only physical but also cognitive endurance, which has significant educational value. The majority of participants (88%) reported that the program imposed increased demands on attention concentration, especially during the final stages of sessions. The ability to make decisions under accumulated fatigue was positively assessed by 82% of respondents, indicating the training of cognitive stability under load. In addition, 85% of participants emphasized the need to maintain sustained attention throughout the entire session, which clearly distinguishes ARVETS from traditional monotonous forms of physical education.

The obtained results indicate that the program creates conditions for integrating cognitive processes into motor activity. From a pedagogical perspective, this reflects a shift from purely physical training toward learning through control, awareness, and decision-making within the movement process (Figure 2).

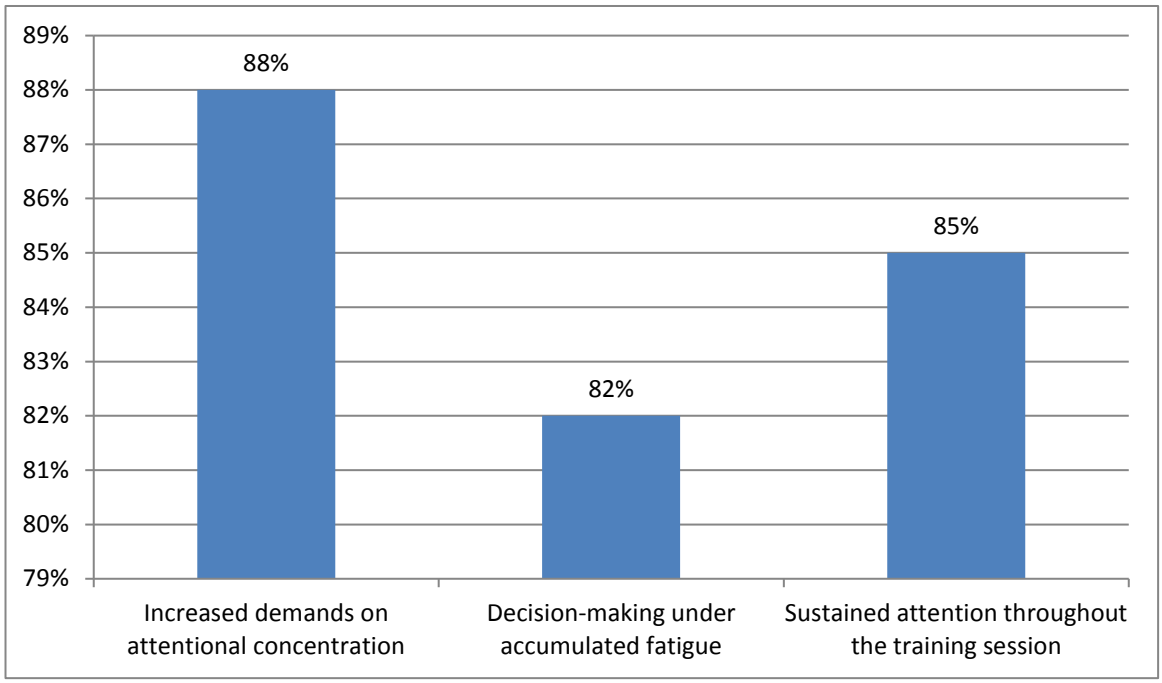

Fig. 2. Indicators of cognitive endurance among participants of the ARVETS program (% positive responses)

Source: Developed by the author

Analysis of responses in the Motor awareness block revealed a substantial increase in participants' bodily awareness. The highest indicator (90%) concerned the ability to perceive one's own movements and their quality during prolonged activity. The ability to notice technical errors and coordination disruptions under fatigue was reported by 78% of respondents, while 83% indicated improved control of movement technique.

These results indicate the development of internal feedback mechanisms, which have important pedagogical significance. From a physical education perspective, this reflects the development of movement culture and bodily reflection, where learning occurs not only through external instructor guidance but through awareness of one's own actions. This approach aligns with contemporary learner-centered educational concepts (Figure 3).

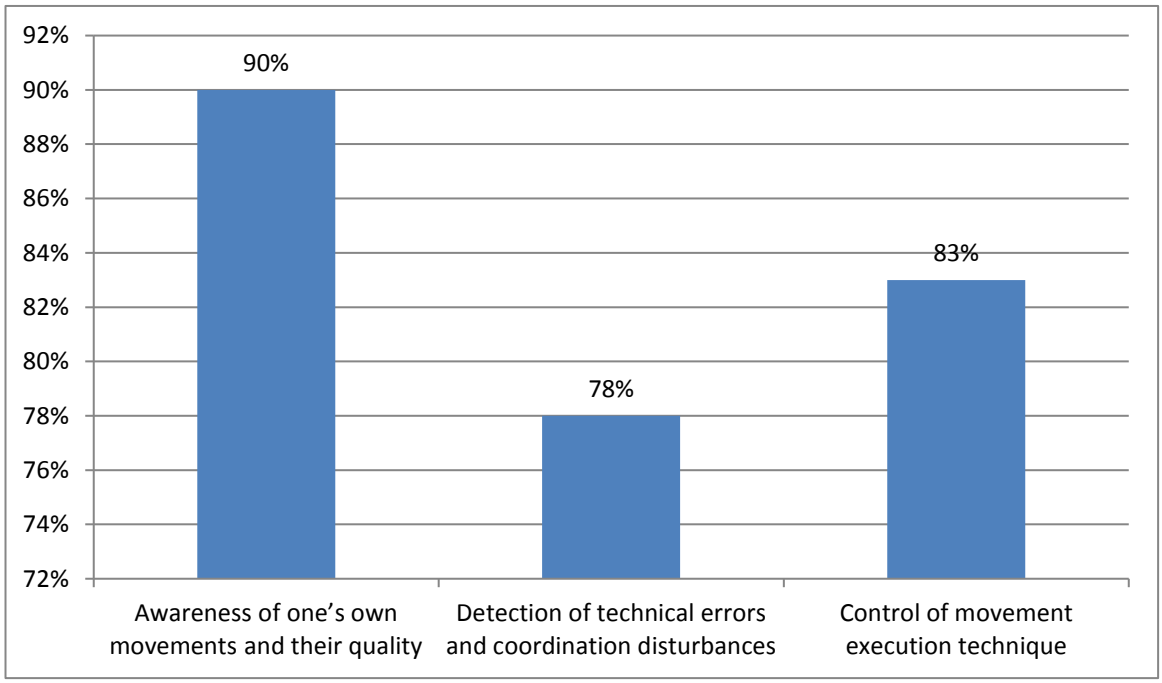

Fig. 3. Indicators of motor awareness among participants of the ARVETS program (% positive responses)

Source: Developed by the author

Analytical examination of the program combined with participant responses demonstrated ARVETS' substantial potential for individualization in physical education. The program enables load adaptation to individual capabilities without rigid standardization, which is especially important in group-based classes.

Participants emphasized that the ARVETS structure maintains a unified session format while allowing individualized pacing and task difficulty. This creates conditions for differentiated instruction without compromising pedagogical control. Thus, ARVETS meets contemporary physical education requirements oriented toward mixed-ability groups and individualized learning trajectories.

Survey results from the Transferability block indicated a positive perception of the program's pedagogical adaptability. The possibility of applying ARVETS principles within physical education was acknowledged by 86% of participants, while 80% noted that key program elements remain effective even at reduced intensity levels.

In addition, 84% of respondents indicated that ARVETS can be used as an educational module aimed at developing endurance, self-regulation, and conscious motor activity. Importantly, this refers not to direct implementation but to the potential integration of the program into physical education courses and modules (Figure 4).

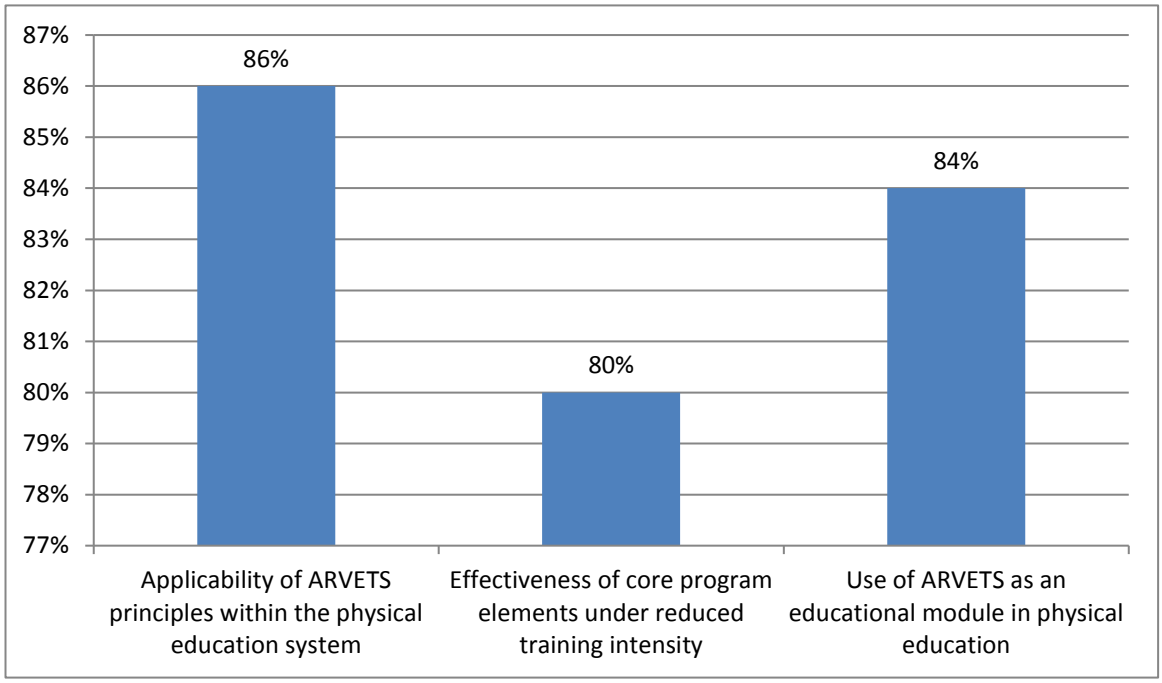

Fig. 4. Indicators of ARVETS program transferability into the physical education system (% positive responses)

Source: Developed by the author

The synthesis of the obtained results made it possible to identify the multidimensional pedagogical potential of the author-developed ARVETS program. The program promotes the development of self-regulation, cognitive endurance, and motor awareness as key educational outcomes of physical education. The combination of adaptability, cognitive engagement, and individualization allows ARVETS to be considered an innovative physical education model oriented toward an active, conscious, and responsible learner. The obtained findings provide a logical basis for further conclusions and for discussing opportunities for the program's practical integration.

DISCUSSION

Our ARVETS program results largely reinforce recent findings on cognitive-physical synergy. Staiano et al. (2022) observed that adding cognitive training after workouts enhanced endurance and attentional control. In a similar way, ARVETS participants demonstrated improved persistence and faster reaction responses, which in an educational context indicate the development of cognitive endurance and self-regulatory capacity rather than purely physical performance. Nien et al. (2020) reported that mindfulness training increased athletes' exhaustion duration and Stroop accuracy, and we found a similar

pattern: ARVETS participants not only rode farther but also solved cognitive puzzles more accurately post-training. Daneshgar-Pironneau et al. (2025) noted endurance athletes resisted mental fatigue better than novices; in parallel. ARVETS participants maintained task engagement and decision accuracy under prolonged cognitive load, suggesting the formation of cognitive endurance as an educational outcome rather than a sport-specific performance effect. In these respects, our findings extend the literature by showing that even adolescents in PE classes can gain the dual physical-cognitive benefits documented in athletes.

Some divergences also emerged. Dallaway et al. (2023) concluded that cognitive training alone did not improve endurance. In contrast, ARVETS participants did improve endurance, likely because our intervention combined cycling with mental tasks. This aligns with the consensus that only integrated approaches work: André et al. (2025) and Staiano et al. (2022) emphasized that "brain endurance" requires simultaneous cognitive and physical stress. Similarly, Zha et al. (2025) reported that CATS increased students' engagement and autonomy in class; we observed that ARVETS students set personal pacing goals and reported greater interest in PE tasks. Thus, where standalone exercises fall short, our combined adaptive model produced gains, underscoring the importance of multi-faceted designs.

The problem revealed is that conventional PE often neglects cognitive stamina and self-regulation, which matters for long-term motivation and health. Our data show that by embedding mental challenges into endurance activities, educators can simultaneously cultivate effortful control and motor awareness. This is important for teachers and curriculum designers, as it suggests a way to engage learners more deeply and build persistence. It also matters for students, who benefit from improved focus and confidence: ARVETS students reported feeling more capable of regulating their effort and understanding how their bodies respond to exercise. Overall, the ARVETS program fills previously identified gaps by offering a structured, adaptive cycling intervention that promotes both physical and cognitive development. By showing tangible gains in endurance, self-efficacy, and motor self-awareness, ARVETS contributes a practical model for PE: one that integrates academic insights into everyday training.

Study limitations. The study is limited by the relatively small and homogeneous sample of professional cyclists, determined by the prior ARVETS program pilot. Pedagogical effects were mainly assessed through self-reported survey data, which may reflect individual perceptual biases.

Recommendations. Future research should examine the pedagogical potential of ARVETS in multi-age and multi-level physical education groups. Combining survey data with objective pedagogical indicators is also recommended to strengthen the evidence base.

CONCLUSION

The study enabled a comprehensive evaluation of the pedagogical potential of the author-developed ARVETS cycling program within physical education. The findings demonstrate that ARVETS goes beyond a traditional training protocol and can be conceptualized as an integrated pedagogical system grounded in core didactic principles, including staged progression, active learner participation, and continuous feedback. The program's clear structural logic-combining preparatory, core, and final phase-ensures the consistent formation of learning outcomes through motor activity.

The integration of physical and cognitive tasks within ARVETS was shown to foster pedagogically significant qualities, particularly self-regulation, cognitive endurance, and motor awareness. Survey results confirmed the development of conscious pacing and load management skills, responsible attitudes toward functional state monitoring, and the ability to maintain concentration and make decisions under fatigue. From a pedagogical perspective, these outcomes indicate the formation of learner autonomy, with participants acting as active learners capable of self-assessment and behavioral adjustment.

A key finding is the program's capacity to promote motor reflection and movement culture. Increased awareness of movement quality and the ability to maintain technical performance under load support the effectiveness of learning through internal feedback, aligning with contemporary learner-centered approaches in physical education. The results also demonstrate the feasibility of individualization and differentiation within group-based formats, which is

essential for multi-level educational environments.

Participants' positive evaluations of program adaptability suggest that ARVETS can function as a promising educational module integrated into physical education without compromising core pedagogical principles. Overall, the findings support further implementation and scholarly exploration of the program in educational contexts.

The novelty of the ARVETS program is reinforced by the submission of a patent application to the United States Patent and Trademark Office (USPTO) as a multistage kinetic training system. This application underscores the originality of the program's structure and mechanisms, examined here from a pedagogical perspective. Scientific novelty lies in substantiating ARVETS as a pedagogical physical education system that integrates physical and cognitive components of endurance and yields educationally meaningful outcomes – self-regulation, cognitive endurance, and motor awareness. For the first time, the pedagogical potential of such a program is analyzed using a structural-functional approach combined with participants' subjective educational effects.

The practical value of the study lies in the applicability of ARVETS principles and structure for designing physical education curricula and learning modules for multi-level groups. The results may inform educators, coaches, and curriculum developers seeking to implement adaptive, cognitively enriched motor activities that support active and responsible learners.

REFERENCES

1. André, N., Audiffren, M., & Englert, C. (2025). Brain endurance training as a strategy for reducing mental fatigue. Frontiers in Psychology, 16, Article 1616171. https://doi.org/10.3389/fpsyg.2025.1616171
2. Dallaway, N., Bray, S. R., Innes, K. L., Andrusko, K. E., & Ring, C. R. (2023). Effects of separate cognitive training on endurance exercise performance. Journal of Functional Morphology and Kinesiology, 10(4), 391. https://doi.org/10.3390/jfmk10040391
3. Daneshgar-Pironneau, S., Audiffren, M., Lorcery, A., Benraïss, A., Mirabelli, F., Gargioli, D., & André, N. (2025). Endurance athletes are more resistant to mental fatigue than nonathletes. Research Quarterly for Exercise and Sport, 96(4), 780–791. https://doi.org/10.1080/02701367.2025.2501972
4. González-Calvo, G., Otero-Saborido, F., & Hortigüela-Alcalá, D. (2022). Discussion of obesity and physical education: Risks, implications and alternatives. Apunts. Educación Física y Deportes, 148, 10–16. https://doi.org/10.5672/apunts.2014-0983.es.(2022/2).148.02
5. Kolovelonis, A., & Goudas, M. (2013). The development of self-regulated learning of motor and sport skills in physical education: A review. Hellenic Journal of Psychology, 10, 193–210. http://hdl.handle.net/11615/29569
6. Nien, J.-T., Wu, C.-H., Yang, K.-T., Cho, Y.-M., Chu, C.-H., Chang, Y.-K., & Zhou, C. (2020). Mindfulness training enhances endurance performance and executive functions in athletes: An event-related potential study. Neural Plasticity, 2020, 8213710. https://doi.org/10.1155/2020/8213710
7. Staiano, W., Merlini, M., Romagnoli, M., Kirk, U., Ring, C. R., & Marcora, S. M. (2022). Brain endurance training improves physical, cognitive, and multitasking performance in professional football players. International Journal of Sports Physiology and Performance, 17(12), 1732–1740. https://doi.org/10.1123/ijspp.2022-0144
8. Valle-Muñoz, V. M., Mendoza-Muñoz, M., & Villa-González, E. (2025). Physical literacy as a pedagogical model in physical education. Children, 12(8), 1008. https://doi.org/10.3390/children12081008
9. Zha, H., Ding, X., & Li, W. (2025). Innovative approaches in physical education: Leveraging cognitive activation to boost student outcomes. Frontiers in Psychology, 16, 1481381. https://doi.org/10.3389/fpsyg.2025.1481381