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A Comparative Analysis of the Sports Intelligence Process in Volleyball Coaches

[*Análisis comparativo del proceso de inteligencia deportiva de los entrenadores de voleibol*]

[*Análise comparativa do processo de inteligência esportiva dos técnicos de vôlei*]

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ABSTRACT

Introduction: The need to broaden the professional perspective of volleyball coaches to favor their social mission requires processes like sports intelligence. This is a necessary working and teaching tool in training and sports competitions by the team, the opponents, and the competition setting.

Aim: To compare the professional performance of volleyball coaches in the field of sports intelligence.

Materials and methods: This pre-experimental design study used theoretical, empirical, and mathematical statistics research methods. The sample consisted of 25 volleyball coaches.

Results: The comparative analysis demonstrated that sports intelligence, as part of complex transdisciplinary studies, contributed to more comprehensive, sustainable, and successful processes that could meet the requirements of modern volleyball, in contrast to the traditional forms used today. The implementation of a set of courses with a transdisciplinary scope allowed volleyball coaches to enhance sports intelligence and improve their professional performance.

Conclusions: Sports intelligence was enhanced as a process, through a set of transdisciplinary courses, and evidenced cognitive, instrumental, and attitudinal changes in volleyball coaches, with repercussions on the coaches' ability to implement this tool.

Keywords: sports intelligence, professional performance, complex transdisciplinary studies.

RESUMEN

Introducción: la necesidad de ampliar aún más el horizonte profesional de los entrenadores de voleibol con vistas a favorecer su encargo social, demanda el empleo de procesos como la inteligencia deportiva. Esta herramienta, es necesaria como medio de trabajo y de enseñanza tanto en el entrenamiento como en la competición deportiva para el estudio del equipo, los contrarios y del entorno competitivo.

Objetivo: comparar el desempeño profesional de los entrenadores de voleibol en cuanto al proceso de inteligencia deportiva.

Materiales y métodos: se realizó un estudio de diseño pre-experimental donde se emplearon métodos de investigación del nivel teórico, empírico y matemáticos-estadísticos. La muestra, objeto de estudio, fue de 25 entrenadores de voleibol.

Resultados: un análisis comparativo mostró que, la inteligencia deportiva, vista desde los estudios transdisciplinarios de la complejidad, permitió desarrollar procesos más

integradores, sustentables, exitosos y estar tono con las exigencias del voleibol moderno a diferencia de la manera tradicional que se desarrolla. La aplicación de un ciclo de cursos con perspectiva transdisciplinar permitió a los entrenadores de voleibol desarrollar un mejor proceso de inteligencia deportiva y con ello mejorar su desempeño profesional.

Conclusiones: se logró perfeccionar el proceso de inteligencia deportiva a partir del ciclo de cursos caracterizados por la perspectiva transdisciplinar y se evidenció cambios en los aspectos cognitivos, instrumentales y actitudinales de los entrenadores de voleibol, lo cual denota que los entrenadores poseen un mejor desempeño para aplicar esta herramienta.

Palabras clave: inteligencia deportiva, desempeño profesional, estudios transdisciplinarios de la complejidad.

RESUMO

Introdução: a necessidade de ampliar ainda mais o horizonte profissional dos treinadores de voleibol, visando favorecer sua responsabilidade social, demanda a utilização de processos como a inteligência esportiva. Esta ferramenta se faz necessária como meio de trabalho e ensino tanto no treinamento quanto na competição esportiva para o estudo da equipe, dos adversários e do ambiente competitivo.

Objetivo: comparar a atuação profissional de treinadores de voleibol quanto ao processo de inteligência esportiva.

Materiais e métodos: foi realizado um estudo de desenho pré-experimental onde foram utilizados métodos de investigação de nível teórico, empírico e matemático-estatístico. A amostra em estudo foi de 25 treinadores de voleibol.

Resultados: a análise comparativa mostrou que a inteligência esportiva, vista a partir dos estudos transdisciplinares da complexidade, permitiu o desenvolvimento de processos mais inclusivos, sustentáveis, exitosos e sintonizados com as demandas do voleibol moderno, ao contrário da forma tradicional como é desenvolvido. A aplicação de um ciclo de cursos com uma perspetiva transdisciplinar permitiu aos treinadores de

voleibol desenvolver um melhor processo de inteligência desportiva e assim melhorar o seu desempenho profissional.

Conclusões: foi possível melhorar o processo de inteligência esportiva a partir do ciclo de cursos caracterizado pela perspectiva transdisciplinar e foram evidenciadas mudanças nos aspectos cognitivos, instrumentais e atitudinais dos treinadores de voleibol, o que denota que os treinadores têm um melhor desempenho para aplicar esta ferramenta.

Palavras-chave: inteligência esportiva, desempenho profissional, estudos transdisciplinares da complexidade.

INTRODUCTION

Recently, Cuban volleyball was challenged by international competition by inserting in the dynamic of complex transformation processes, with adjustments, and impacts produced by the scientific and technological advances in the sport. Hence, coaches require theoretical-methodological adjustment, both at the elementary and higher levels. However, despite the efforts for new changes in the sport made in the province of Granma, the current expectations of modern volleyball were unmet.

The local coaches have limited knowledge, skills, and attitudes in terms of using tools like sports intelligence, which has a remarkable impact on training and competitive performances. These technologies permit the acquisition, analysis, and inclusion of relevant information about the dynamics of the team, the opponents, and competitive settings, thus enabling decision-making and competitive advantages that ensure positive outcomes in the short, mid, and long terms (Dopico & Fernández, 2018; Becali & Hernández, 2022; Cabrera *et al.,* 2022).

Besides, this process consists of several training and competition moments that join athletes and coaches together. These stages must be studied, measured, and diagnosed by multidisciplinary groups of biomechanics, statisticians, psychologists, and physicians (Dopico & Fernández, 2018). It has been developed according to the contemporary

demands of modern sports development that require discipline with a more comprehensive scope and must embrace transdisciplinary studies of complexity. Martínez & Lech (2022) have noted that these studies constitute an integration mechanism that permits the articulation of relatively distant areas of knowledge, particularly, sports intelligence. The ideas, principles, concepts, notions, and premises that foster these studies go beyond the traditional barriers, discipline limits, or cognitive areas, to address the complex issues that challenge job performance.

In sports, these studies have helped transform new or complex situations into known or simpler settings, to make timely decisions, optimize training plans and systems, anticipate, adapt to new scientific breakthroughs, and overcome existing shortcomings creatively and sagaciously (Torrents, 2005; García, 2013; Albarrán, E.J. 2020). However, quite a few volleyball coaches can understand and embrace sports intelligence and all its novelty for implementation in training sessions and sports competitions to enhance professional performance and achieve better sports results.

Hence, coaches should get proper preparation, as suggested by Cabrera *et al.* (2022), master the theoretical, methodological, and practical fundaments of sports intelligence, and use complex interdisciplinary studies to conduct this process. It contributes to sustainable volleyball development in the community, the municipality, the province, and the country. It offers the possibility of success, breaking structures, learning to see through someone else's eyes, being open to changes and adapting, being conscious and consequent to the objective reality, and identifying and addressing problems not only within the sports setting.

In Cuba, Del Toro and Bermúdez, 2011, Dopico & Fernández (2018) have dealt with sports intelligence preparation. These actions have remained at a discipline and interdisciplinary level, the conception of these processes, and tackle general aspects of every sport, focusing mainly on sports psychology, sports team management, and information management, rather than the volleyball game, which at times, deviates the interpretation and contextualization from some contexts. More particularly, (Navelo,

Ruiz & Navelo 2023), in a study of volleyball, just addressed technical-tactical aspects from information collected through observation and statistics.

The analysis of published research concluded that improvements in the professional performance of volleyball coaches require more comprehensive and transdisciplinary training in sports intelligence. Hence, "... the training needs of society based on the creation of professional capacities to meet new challenges and promote transdisciplinarity" are completely met, as principles of postgraduate education endorsed in the new MES Resolution (MES, 2019, p. 2).

Cabrera *et al.* (2021) highlighted that the fulfillment of these principles contributes to encouraging dialogue and the integration of knowledge, and professional performance excellence, along with more creative and sustainable solutions, professionally, personally, and socially. Therefore, the aim of this paper is to compare the results observed in the cognitive, attitudinal, and instrumental dimensions in the professional performance test of sports intelligence to the volleyball coaches of the province of Granma.

MATERIALS AND METHODS

This research was based on a pre-experimental design including the same number of coaches, consisting of a pre-test and post-test that facilitated the verification of training actions recommended in the municipality of Jiguani, Granma (Cuba), between September and December 2021 (a week a month, two courses each week). According to the intentional and deliberate criteria for the selection of the sample, 25 volleyball coaches were chosen, who met the following inclusion criteria: to have a bachelor's degree in Physical Culture, be volleyball coach, and have attended the preparatory course Transdisciplinarity and Sports Intelligence.

The evaluation of coaches relied on the professional performance test, which evaluates the cognitive dimension (how to learn): the system of ideas, concepts, categories, facts,

phenomena, laws, and theories that express mastery of the essential theoretical-methodological knowledge so coaches are able to learn and implement sports intelligence with a comprehensive strategic perspective. Attitudinal dimension (how to be): volleyball coaches' attitude to improve topics like sports intelligence as a comprehensive strategic perspective. Instrumental dimension (how to do): methodological actions of coaches to implement sports intelligence in training and competition.

The research used the following methods and techniques: analytical-synthetic, hypothetical-deductive, systemic-structural-functional, document review, interviews, surveys, observation of training sessions, and methodological triangulation. The statistical methods and procedures included were empirical frequency distribution, and the Wilcoxon hypothesis test for the related samples. SPSS 11.5, for Windows, was used to determine the statistical significance level of changes, through the non-parametric test, with alpha = 0.05 as a significant level. The data were processed using Microsoft Office Excel 2010, for Windows XP.

RESULTS AND DISCUSSION

The current outcome derives from Ph.D. thesis dissertation A Professional Training Strategy to Develop Sports Intelligence in Volleyball Coaches. A methodological triangulation was made with the data collected from a painstaking diagnostic study of articles, theses, books, the Physical Culture degree curricula, Training plans for volleyball coaches in Granma, the Comprehensive Training Program for the Volleyball Athletes, the coaches' training programs, and training and competition observation. The results revealed the current professional performance of volleyball coaches in Granma amid the good judgment and the flaws observed around sports intelligence.

The outcome showed that volleyball had become a complex sport, as noted by (Núñez, 2011; Font-Rodríguez *et al.* 2017; Martínez & Ruiz, 2022). Related studies in volleyball

unveiled that the International Volleyball Federation (FIVB) and the Cuban Volleyball Federation (FCV) have taken action to enhance the coaches' professional performances, such as the use of computer systems (the Volleyball Information System (VIS) by the FIVB, the Data Volley Professional, VolleySoft, and DakStats, to get competitive advantages. Besides, they consider that the professional level of coaches plays an important role in sports results. However, these information recording and processing systems are mainly focused on statistics through technical-tactic player performance in real-time, not to mention important variables to succeed in sports, such as emotional intelligence. These systems are sometimes slow to acquire the novel aspects of volleyball. Generally, high-performance teams have exclusive access to them, which hinders knowledge and skill acquisition on this significant tool.

Moreover, there are few training strategies on sports intelligence that adjust and improve today's volleyball. The shortcomings also include poor theoretical-methodological adjustment of volleyball coaches in terms of sports intelligence, and the limited professional skills of coaches to implement sports intelligence strategies during training and competition.

Usually, sports intelligence is known by coaches from different cognitive angles, such as sports information management, sports team management, and sports psychology, which additionally, are poorly articulated. Two archetypes can be mentioned: 1) in sports information management, knowledge management is not fully assimilated, and 2) still, positivist prejudices exist about the so-called strict preference approach (Paolo Freire's language stagnation) of disciplining in sports psychology, rather than using a more productive psycho-pedagogic conception with an interdisciplinary articulation.

The study also showed that 85 % of the sample had limited knowledge and skills to articulate other relatively distant areas of knowledge into sports intelligence, with a prevalence of authoritarian managing style by coaches.

All the subjects acknowledged the limited knowledge of complex transdisciplinary studies, as they received little information. The coaches showed limited knowledge and

skills to implement sports intelligence in training and competition, and they showed a high attitude to improve in these areas, according to the performance test.

The analysis helped find significant elements to take training actions with a transdisciplinary perspective oriented to developing sports intelligence in interested volleyball coaches. The specificities of this perspective and its common language enable the articulation of cognitive areas that deal with sports intelligence traditionally, along with other areas of knowledge and combined topics.

To overcome these barriers, at least two significant logical procedures must be performed, which relate to the theoretical-methodological adjustment with a transdisciplinary perspective:

To acquire the still-developing articulatory language of complex transdisciplinary studies, so that vices and routines of the prevailing reductionism that privileges the above disciplines and their self-isolation, cannot hinder the articulation and mutual fertilization of areas of knowledge and combined topics, which are seldom attributed to knowledge associated with sports intelligence, such as biology, neurophysiology, logic, philosophy, military art, sociology, pedagogy, and others.

Generating an endogenous adjustment of ideas (itinerant control, creativity, crisis, emergency, empowering, mediation, trans-referentiality), principles (high sensitivity to initial changes, self-organization, contextualization, structural stability, non-linearity, order and disorder, scale-up, equifinality, lack of clear limits, hologram, uncertainty, multi-referentiality, singularity, epistemological reflexivity), concepts (acting, self-catalysis, learning, attractor, consensus, context, phase space, dissipating structures, fractal, information, mediation, order and disorder, disturbance, rupture of symmetry, unpredictability, transversality, feedback), notions (self-consciousness, self-management, self-regulation, self-determination, self-control, self-assessment, personal creativity, collective, motivation, ideals, engagement, intentions, collective leadership, distributed role participation), and premises (coupling, synchrony, adjustment, engagement, networks-rhizomes, unpredictable and chaotic, adaptative robustness and

homeostasis, transferability, recursivity). All these theories and approaches to complexity are currently interrelated continuously and systematically, thus creating a boost of immediate applications in every field of life through new theoretical and methodological transdisciplinary combinations, as well as the implementation of new state-of-the-art technologies applicable to the particular concept of training and competition in volleyball.

Therefore, a set of courses are recommended, which include sports intelligence with a transdisciplinary perspective, aiming to enrich the theoretical-methodological adjustment of volleyball coaches in the province of Granma, to enhance sports intelligence (Table 1).

Table 1 *- Course cycle program*

Activities	Objective
Pre-course: Transdisciplinarity and sports intelligence.	To implement ideas, concepts, and notions about complex transdisciplinary studies in sports intelligence applied to volleyball.
Course 1: The methodological teaching process of volleyball.	To use tools, teaching, and methodological aids in the game, considering the contributions of complex transdisciplinary studies.
Course 2: Emotional intelligence in volleyball.	To implement techniques and use tools for effective emotional self-management and control of other athletes' emotions, considering the contributions of complex transdisciplinary studies.
Course 3: Strategic management of sports teams.	To implement management techniques and methods, and use management tools in the volleyball teams, considering them a complex dynamic system.
Activities	Objective
Course 4: Sociometry and organizational dynamics of small groups.	To implement psycho-sociological tools and techniques to enhance and exploit collective intelligence in the team.
Course 5: Bioethical behavior in volleyball	To contribute to the bioethical behavior in the process of sports intelligence in the training sessions and competitions.
Course 6: Sports intelligence with a transdisciplinary scope	To implement techniques and use tools to address related problems, comprehensive team study, the opponents, and the competitive setting, by articulating cognitive areas, considering the contributions of complex transdisciplinary studies.

An underlying part of the professional training process, learning can be internalized by coaches for future implementation in the training and competition of volleyball. The construction of this knowledge is achieved through dialectic relations established

between the contents of the first course through the last one, in which this knowledge integrates and consolidates.

To corroborate the effectiveness of the proposal, a step-by-step professional performance test based on the following scale: 12 points (very good results), 8 points (good results), 6 points (results with some shortcomings), 2 points (deficient results), which applies to volleyball coaches in the study. The pre-test and post-test results were compared, and it was revealed that in the cognitive dimension, the pre-test showed 96.8 % of coaches with limited knowledge, and deficiencies in their performance to implement sports intelligence during training and competition. Over 53.6 % of coaches showed partially deficient results, with mostly empirical practices subordinated to the opinions of the executives. Likewise, the limited knowledge about the contribution of ideas, principles, concepts, notions, premises, and theories derived from discipline approaches to human intelligence, complex transdisciplinary studies, and the theory of complex dynamic systems in sports intelligence, just to cite a few examples.

However, after the application of the course cycle, a significant difference was observed between the pre-test and the post-test in this dimension according to the Wilcoxon hypothesis test for related samples, with a probability below the alpha significance level, as shown in Figure 1. It resulted from the knowledge acquired (How to know) by the volleyball coaches during the course cycle. More than 69.6 % of coaches showed good and very good results in this dimension, which leads to the conclusion that coaches know the basic elements of sports intelligence and know how to identify, extrapolate, and integrate other areas of knowledge to achieve better sports results in the short, mid, and long terms.

The coaches were able to understand and embrace ideas, principles, concepts, notions, and premises of the ideas of complexity in their performance. They could master this new paradigm so that they can produce significant changes based on the information collected on the team's dynamic, and identify the opponent's patterns, trends, weaknesses, and strengths, as well as those of the competitive setting to increase the adaptative solidity of the team, self-organize, and enhance sports performance, along

with improvements in the relationships between the main actors engaged in the sports intelligence process in volleyball.

They recognize the need to include or induce, premeditated and controllably, the disorder or entropy part of the complex training and competition processes.

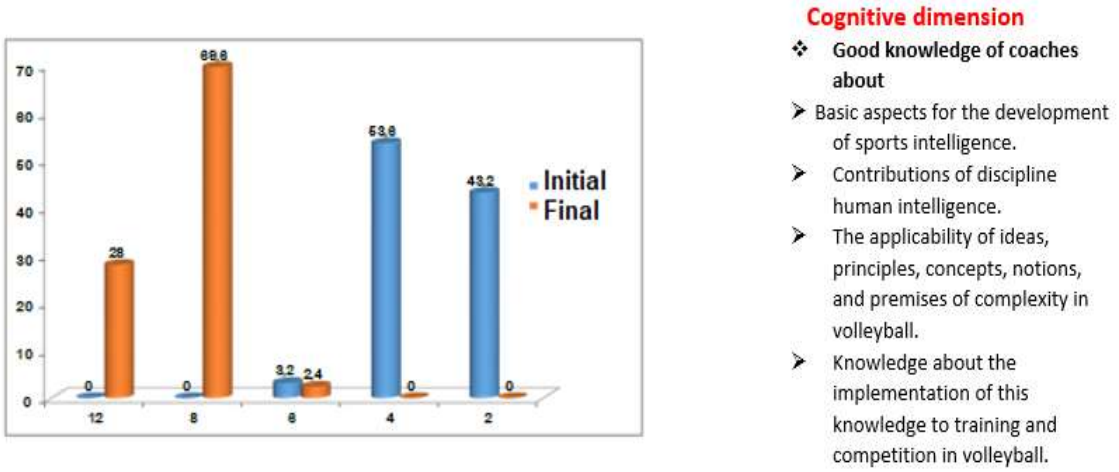


***Fig. 1**. Pre-test and post-test results in the performance test of volleyball coaches*

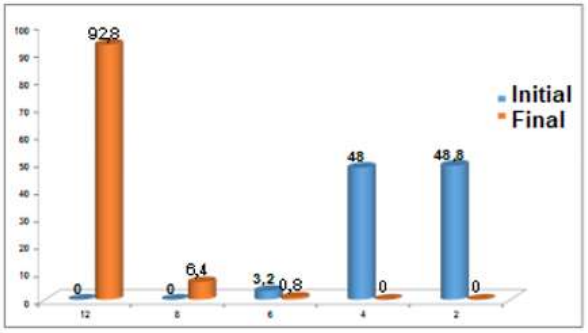
Assessing scale: 2 points (deficient), 4 points (partially deficient), 6 points (acceptable), 8 points (good), 12 points (very good) (Table 2).

Table 2. - Assessing scale

	ACF - ACI	CNF - CNI	ALCF - ALCI	CMF - CMI	NCF - NCI
Z	-2.032(a)	-2.032(a)	-.552(a)	-2.032(b)	-2.032(b)
Asymp Sig. (2-tailed)	.042	.042	.581	.042	.042

A comparison between the pre-test and post-test in the attitudinal dimension showed significant differences, with a probability below the alpha significance level, according to the Wilcoxon hypothesis test for related samples. The pre-test showed that 100% of coaches hoped to get better training in areas related to sports intelligence, whereas more than 92 % expressed their doubts about the contributions of the new content to training and competition in volleyball. They also expressed low levels of ethical commitment and

behavior associated with teamwork, showing limited knowledge about it. Following the training strategy, the results were different, as 92.8 % expressed their certainty and confidence in the knowledge and skills acquired during the courses, thus confirming the responses given in this dimension. Moreover, there was a high motivational level and desire to take more training and conduct research in areas related to sports intelligence, and the values embraced during the process. The coaches' attitude to acknowledge a new vision of sports intelligence and contribute to the formation of a new generation of volleyball players, based on the acquisition of new knowledge from other cognitive areas that will benefit training and competition in volleyball. However, after the application of the course cycle, a significant difference was observed between the pre-test and the post-test in this dimension according to the Wilcoxon hypothesis test for related samples, with a probability below the alpha significance level, as shown in Figure 2.



Attitudinal dimension

❖ **The coaches manifested that,**

- They are motivated to carry on with their training of sports intelligence.
- They are confident of their abilities to include the knowledge from other areas in sports intelligence.
- They are willing to implement the contributions offered by complex transdisciplinary studies to sports intelligence.
- They are willing to put into practice all the knowledge about sports intelligence with a comprehensive perspective.
- They transmit values during the sports intelligence process.

Fig. 2. *- Pre-test and post-test results in the performance test of volleyball coaches*

Assessing scale: 2 points (deficient), 4 points (partially deficient), 6 points (acceptable), 8 points (good), 12 points (very good) (Table 3).

Table 3. *- Assessing scale*

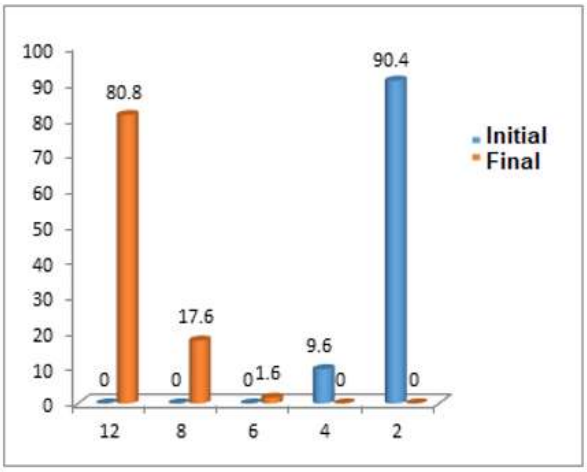
	MBF - MBI	BF - BI	AF - AI	ADF - ADI	DF - DI
Z	-2.060(a)	-1.841(a)	-1.089(b)	-1.841(b)	-2.032(b)

Asymp. Sig. (2-tailed)	.039	.066	.276	.066	.042

The comparison between the pre-test and post-test in the instrumental dimension during the coaches' performance test showed the limited knowledge of coaches when the per-test was performed; they also showed poor skills to articulate other areas of knowledge to sports intelligence looking to address training and competitive issues. Likewise, more than 90.4 % of coaches only used the creative potentialities of each member, and the collective mind (all the actors: players, coaches, executives, support staff).

Meanwhile, the post-test showed that after the training strategy was implemented, the coaches showed very good results, of which 80.8 % demonstrated their skills (how to do) to acquire, analyze, and use relevant information about the team's dynamic, the competitive actions of their opponents, and competitive settings, with a capacity to generate real transformation using the tools given by sports intelligence for training and competition, looking to achieve higher sports outcomes.

The coaches' skills to apply the SWOT matrix were also noted, in addition to planning and organizing training, considering the real needs of their teams, as well as the actions of the opponents in previous competitions. Also important are the abilities to articulate the training and competition processes in volleyball, new ideas, approaches, and premises to contribute in the short, mid, and long term to sports performance in volleyball in the province, and guarantee an inventory of novel players in the country. This articulation develops knowledge, intelligence, creativity, sensation, perception, memory, thinking, imagination, values, habits, abilities, and capacities. The statistics of the dimension, according to the Wilcoxon hypothesis test for related samples, showed similar values, concerning the significant differences between the pre-test and post-test, with a probability below the alpha significance, as shown in Figure 3.



Instrumental dimension

- **Very good coach skills to,**
- Apply the basic elements of sports intelligence in volleyball.
- Implement the contributions of other areas in sports intelligence.
- Apply the theoretical-methodological contributions offered by transdisciplinary approaches to sports intelligence.
- Apply complex transdisciplinary studies in sports intelligence applied to volleyball.
- Apply RD with a comprehensive conception.

Fig. 3. - *Pre-test and post-test results in the performance test of volleyball coaches*

Assessing scale: 2 points (deficient), 4 points (partially deficient), 6 points (acceptable), 8 points (good), 12 points (very good) (Table 4).

Table 4. - *Assessing scale*

	MBF - MBI	BF - BI	AF - AI	ADF - ADI	DF - DI
Z	-2.032(a)	-2.060(a)	-1.841(a)	-1.000(b)	-2.121(b)
Asymp. Sig. (2-tailed)	.042	.039	.066	.317	.034

CONCLUSIONS

The new ideas, principles, concepts, notions, and premises about complex transdisciplinary studies can be implemented in the area of volleyball, with a different and more effective sports intelligence process.

Sports intelligence was enhanced through a set of transdisciplinary courses and evidenced cognitive, instrumental, and attitudinal changes in volleyball coaches.

The comparative analysis of the professional performance test to measure sports intelligence in volleyball coaches in the province of Granma showed a significant difference, thus confirming the effectiveness of the proposal based on a course cycle proposal.

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The authors declare having competing interests.

Author contribution statement:

The authors have participated in the redaction of the manuscript and the documentary review.