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# Ciencia y Deporte



## *Methodology for studying opponents in karate kumite*

*[Metodología de estudio de contrarios en el kumite de karate]*

*[Metodologia para o Estudo dos Adversários no Kumite de Karate]*

Edsnel Eugenio Daudinot Llibre <sup>1\*</sup>  · Eudis Milán Leyva <sup>1</sup>  , Fernando Puente Gamboa <sup>1</sup> 

<sup>1</sup>University of Guantánamo. Faculty of Physical Culture. Guantánamo, Cuba.

\*Corresponding author: edsnelkrt2@gmail.com

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### **ABSTRACT**

**Introduction:** The study of opponents in karate kumite is a key function within sports intelligence, allowing athletes to anticipate and counter their strategies. In Cuba, limitations have been identified in the systematization and application of this process, affecting the technical and tactical performance of top-level karate practitioners.

**Objective:** To develop a methodology supported by a system of indicators for the study of opponents in karate kumite.

**Materials and methods:** A mixed-methods quasi-experimental design was used, developed in three phases: diagnosis, implementation, and evaluation. Six top-level karate coaches participated. Interviews, surveys, structured observation, and a pretest-

posttest design were used. The analysis combined descriptive and inferential statistics with qualitative triangulation.

**Results:** The methodology allowed for the identification and overcoming of deficiencies in the knowledge and practice of opponent analysis. Coach preparation and the technical-tactical performance of karate practitioners were improved. The system of indicators integrated conceptual, procedural, attitudinal, and statistical dimensions, overcoming previous fragmented approaches. Challenges are recognized in empirical validation, technological integration, and sample representativeness.

**Conclusions:** The validated methodology offers a replicable protocol for studying opponents in karate kumite, with a positive impact on the training of coaches and athletes. It is recommended to expand the validation to other contexts and strengthen technological integration to optimize sports intelligence in Cuban karate.

**Keywords:** performance analysis, opponent study, sports intelligence, karate, methodology.

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## **RESUMEN**

**Introducción:** el estudio de contrarios en el kumite de karate es una función clave dentro de la inteligencia deportiva, que permite anticipar y contrarrestar las estrategias de los oponentes. En Cuba, se identifican limitaciones en la sistematización y aplicación de este proceso, afectando el rendimiento técnico-táctico de los karatecas de primera categoría.

**Objetivo:** elaborar una metodología apoyada en un sistema de indicadores para el estudio de contrarios en el kumite de karate.

**Materiales y métodos:** se empleó un diseño cuasiexperimental mixto, desarrollado en tres fases: diagnóstico, implementación y evaluación. Participaron seis entrenadores de Karate de primera categoría. Se utilizaron entrevistas, encuestas, observación estructurada y un preexperimento pretest-posttest. El análisis combinó estadística descriptiva, inferencial y triangulación cualitativa.

**Resultados:** la metodología permitió identificar y superar deficiencias en el conocimiento y la práctica del estudio de contrarios. Se mejoró la preparación de entrenadores y el desempeño técnico-táctico de los karatecas. El sistema de indicadores integró dimensiones conceptual, procedimental, actitudinal y estadística, superando enfoques fragmentados previos. Se reconocen desafíos en validación empírica, integración tecnológica y representatividad muestral.

**Conclusiones:** la metodología validada ofrece un protocolo replicable para el estudio de contrarios en el kumite de karate, con impacto positivo en la formación de entrenadores y atletas. Se recomienda ampliar la validación a otros contextos y fortalecer la integración tecnológica para optimizar la inteligencia deportiva en el karate cubano.

**Palabras clave:** análisis del rendimiento, estudio de contrarios, inteligencia deportiva, kárate, metodología.

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## RESUMO

**Introdução:** O estudo dos adversários no kumite de Karate é uma função chave dentro da inteligência esportiva, permitindo antecipar e contrariar as estratégias dos oponentes. Em Cuba, foram identificadas limitações na sistematização e aplicação desse processo, afetando o desempenho técnico-tático dos karatecas da primeira categoria.

**Objetivo:** Elaborar uma metodologia apoiada em um sistema de indicadores para o estudo de contrários no kumite de Karate.

**Materiais e métodos:** Foi utilizado um desenho quase-experimental misto, desenvolvido em três fases: diagnóstico, implementação e avaliação. Participaram seis treinadores de Karate da primeira categoria. Foram aplicadas entrevistas, questionários, observação estruturada e um pré-experimento com pré-teste e pós-teste. A análise combinou estatísticas descritivas, inferenciais e triangulação qualitativa.

**Resultados:** A metodologia permitiu identificar e superar deficiências no conhecimento e na prática do estudo dos adversários. Houve melhoria na preparação dos treinadores e no desempenho técnico-tático dos karatecas. O sistema de indicadores integrou dimensões conceitual, procedimental, atitudinal e estatística, superando abordagens

fragmentadas anteriores. Persistem desafios na validação empírica, integração tecnológica e representatividade da amostra.

**Conclusões:** A metodologia validada oferece um protocolo replicável para o estudo dos adversários no kumite de Karate, com impacto positivo na formação de treinadores e atletas. Recomenda-se ampliar a validação para outros contextos e fortalecer a integração tecnológica para otimizar a inteligência esportiva no Karate cubano.

**Palavras-chave:** análise de desempenho, estudo dos adversarios, inteligência esportiva, Karate, metodologia.

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## *INTRODUCTION*

In recent decades, modern sports training has undergone a significant transformation thanks to the integration of science and innovation. This progress has not only elevated athletes' performance to unprecedented levels but has also fostered their holistic development. Science and technology have contributed knowledge that goes beyond simply optimizing performance, including scientific training methodologies, sports nutrition, biomechanical analysis, exercise physiology, sports psychology, and technological tools such as video analysis and monitoring systems.

In this context, sports intelligence, and in particular the study of opponents, has become an essential strategic tool for maximizing performance in competitive disciplines. Sports intelligence enables coaches and athletes to make informed decisions based on concrete data about their opponents.

This research focuses on the study of opponents in karate kumite, a process that involves gathering and analyzing information about rivals' strengths, weaknesses, and behavioral patterns. In a sport where every move can be decisive, anticipating the opponent's strategies is fundamental to designing tactics that make a difference in high-level competitions.

This approach aligns with the guidelines of the Constitution of the Republic of Cuba, which promotes the comprehensive development of sport as a right of the people and a means to achieve excellence. It also responds to the technological demands of the National Institute of Sports, Physical Education and Recreation (INDER), as well as the statutes of the World Karate Federation (WKF) and the Cuban Karate-Do Federation, which promote comprehensive training that incorporates advanced technologies to guarantee the international competitiveness of Cuban athletes.

Sports intelligence is a high-impact task within the national program "Sport and Human Development," which seeks to strengthen the quality of Cuban sport through research that addresses technological demands and the development of human talent. The Cuban Sports Research Center (CIDC) plays a key role in this process, promoting studies and innovations to raise sporting standards in Cuba. Furthermore, the president of the National Institute of Sports, Physical Education and Recreation (INDER), Osvaldo Vento Montiller, has emphasized the need to refine the tools to improve the rigor of the sports intelligence process, including the implementation of new technologies and methodologies that optimize sports management. Therefore, this research is highly relevant and important.

The central purpose of this study is to address a key task within sports intelligence: the analysis of opponents in karate kumite. This task requires the coach to be prepared to gather and analyze information about opponents, their strategies, strengths, and weaknesses, allowing them to anticipate movements and formulate tactics that optimize both the individual performance of the karateka and the collective performance of the team.

Internationally, several authors have researched related topics. In his work, Santesmases (2010) provides a key resource for understanding and developing tactical intelligence in sport, integrating theory and practice to optimize tactical learning and performance.

For his part, Kahneman (2011), a Nobel Prize-winning psychologist, has studied decision-making and intuitive thinking, concepts applicable to sports intelligence and the analysis of cognitive processes. The authors López *et al.* (2015) contribute a rigorous and novel method for analyzing technical-tactical behavior in Taekwondo, supported by specific software that allows for mapping and a better understanding of combat interactions and their impact on scoring.

In Cuba, Álvarez (2003) has worked on definitions, characteristics, and examples of the term's strategies, tactics, and techniques for improving performance in sports. In boxing, Sobrado *et al.* (2008) address the development of software for studying opponents. This system aims to facilitate quick and organized access to technical and tactical data about rivals.

Sports Intelligence "Suite" was created. This suite is a 100% Cuban-developed computer system that integrates several modules, including one specifically for studying opponents, which facilitates the technical and tactical analysis of rivals in combat sports such as boxing (JIT, 2024). Along the same lines, Becali (2022) has addressed topics related to opponent analysis as part of sports intelligence, specifically in judo.

In the territorial sphere, Dopico (2013-2018) has contributed important conceptualizations and definitions to this research. Also noteworthy are Daudinot and Puente (2022), who developed an observation protocol for the technical-tactical study of the opponent in karate-do kumite.

Despite these contributions, there is insufficient awareness among coaches regarding the importance of opponent analysis as an essential link between training strategies and competition tactics. Therefore, it is crucial to develop an appropriate sports intelligence process that allows for the identification and analysis of opponents' behavioral patterns, something currently lacking in Cuban karate. This is indispensable for coaches to prepare karate practitioners in opponent analysis, facilitating informed decision-making in strategic and tactical planning, which is especially relevant in a discipline where understanding the opponent can determine success or failure.

Although existing research has theoretical and practical value, it is insufficient in terms of concrete contributions to the systematic application of opponent analysis in kumite. This deficiency highlights the need to delve deeper into the dynamics of the process and improve methodologies from the earliest stages of training.

In the academic curriculum, the study of opposing forces should be approached from various disciplines so that graduates can perform effectively as sports coaches. This requires a didactic approach that allows for the application of theoretical knowledge in practical situations. However, shortcomings in practice and a lack of effective integration between the different areas of knowledge involved are evident.

Although it draws on experiences and knowledge from various disciplines, these are not always properly contextualized within karate, and the lack of a comprehensive approach that considers the sport's specific characteristics limits the effectiveness of opponent analysis. Furthermore, the methods and approaches employed often lack coherent planning, leading to disconnection and dispersion that hinder their consolidation as a fundamental part of training.

Furthermore, the implementation of opponent analysis is often sporadic and unsystematic, lacking targeted planning, which leaves coaches without the necessary guidance and preparation to address this critical aspect. This is reflected in the fragmented approach to the disciplines involved, preventing the analysis of opponents from being considered a fundamental pillar of training.

In this context, it is essential to identify key points to avoid inconsistencies in implementation, such as improving guidance for conducting effective analyses during competitions and developing methodological work with practical implications for future professional performance.

Another problem limiting the effectiveness of opponent study is the lack of depth and mastery of its practical application, which hinders the integration of this function into the educational and training process for coaches. This also affects karate practitioners,



who face limitations in their professional development due to the absence of a deliberate focus during their training. Furthermore, coaches often lack clear strategies to facilitate the integration of the disciplines involved in the methodological process.

These assessments were confirmed by the empirical investigations carried out in this research, as well as by the author's experience as a top-level karateka in Guantánamo, a member of the national team's reserve squad, and a karate instructor at the University of Guantánamo. Among the main shortcomings identified in the diagnosis are:

1. Theoretical, practical and methodological limitations in the sports intelligence process for the study of opponents in karate kumite with an integrative approach.
2. Lack of pathways and procedures for the study of opposites that, based on their structural relationships, reveal an integrative approach.
3. Poor performance of the top-level karate practitioners, demonstrating a lack of focus in the study of opponents.

Following this analysis, a fundamental contradiction arises: the insufficient preparation of top-level coaches for the evaluation of opponent study in kumite, compared to the contemporary demands of the sports intelligence process in karate.

Based on the analysis of the problem and the theoretical references, the following scientific problem is declared: How to contribute to the improvement of the study of opponents in karate kumite?

To provide an answer, the following objective is proposed: to develop a methodology supported by a system of indicators for the study of opponents in karate kumite.

## ***MATERIALS AND METHODS***

A quasi-experimental study with a mixed-methods (quantitative-qualitative) design was conducted, structured in three cyclical phases: diagnosis, implementation, and evaluation. This design allowed for the integration of philosophical, psychological, and pedagogical foundations for the improvement of the study of opponents in karate kumite.

The study population consisted of six top-level karate coaches from Guantánamo Province, Cuba. Coaches with at least five years of experience in high-performance training were included. The sample was purposive and represented the total number of coaches available in this category.

The following methods were used for the development of the research:

Theoretical methods:

Analytical-synthetic, hypothetical-deductive, documentary analysis and functional systemic-structural to substantiate and design the methodology.

Empirical methods:

Interviews, surveys, observation: to learn about the practices and criteria on the study of opposites and to assess its importance and orientation.

Critical opinion and collective construction workshops: to socialize and validate the research results.

Pre-experiment (pretest-posttest with single group) to evaluate the effectiveness of the proposed methodology.

The materials used include competition videos, observation protocols, SPSS software, and Excel for statistical analysis.

The research process unfolded in three main phases that were interconnected cyclically to ensure the coherence and depth of the study. In the first phase, corresponding to the initial diagnosis, semi-structured interviews were conducted with coaches and surveys were administered to Inder directors, with the aim of identifying current practices, knowledge, and limitations in the study of opponents in karate kumite.

Simultaneously, structured observation was conducted during training sessions and competitions to evaluate the karate practitioners' actual performance and the coaches' practical application of strategies. This phase allowed for the identification of specific training gaps and needs, which informed the next stage.

The second phase consisted of implementing the proposed methodology, training coaches in theoretical and practical aspects of sports intelligence and the use of the indicator system for opponent analysis. The training included hands-on workshops that facilitated the understanding and application of the concepts, as well as the integration of tools for opponent analysis, including the use of competition videos and the development of customized tactical plans.

This phase was key to promoting a change in training practices and strengthening the comprehensive preparation of karate practitioners. Finally, in the evaluation phase, the post-intervention observations were replicated to measure progress in the application of opponent analysis and in the performance of the karate practitioners. The data obtained were analyzed using descriptive and inferential statistical techniques to compare the pre- and post-intervention results, thus validating the effectiveness of the proposed methodology.

In addition, critical feedback workshops were organized with coaches and experts to refine and adjust the methodology, ensuring its relevance and feasibility in real-world training and competition contexts. This comprehensive approach guaranteed the systematic nature, contextualization, and active participation of the key stakeholders in the research process.

Descriptive statistics (absolute and relative frequencies) were used for qualitative variables, and inferential statistics with non-parametric tests (Wilcoxon and McNemar tests) were used to compare pre- and post-intervention results. Triangulation of qualitative and quantitative data was performed to validate findings.

Informed consent was obtained from all participants and confidentiality and anonymity were guaranteed.

## ***RESULTS AND DISCUSSION***

As a solution to the stated problem, a methodology for studying opponents in karate kumite was developed. Its objective was to equip karate coaches with methods and procedures for analyzing opponents in kumite. Its design required a comprehensive understanding of normative, theoretical, and methodological documents to enable its effective implementation. It integrated opponent analysis as a component of sports intelligence, taking into account both the practical experience of coaches and national demands, as well as the characteristics of karate practitioners (age, technical level, competitive context).

According to Milán (2021), the methodology was an instrument for solving educational problems, comprised of stages oriented towards real needs. The proposal focused on three cyclical phases (diagnosis, implementation, evaluation), consistent with pedagogical objectives and based on a comprehensive diagnosis, guaranteeing a contextualized intervention.

The present methodology integrated the aforementioned theoretical and practical elements, along with a concrete example of its application in the study of opponents in Karate kumite. Taking these premises into account, the author of this research defined the methodology as “a system of ideas for projection, integrative composition, concerted procedure, and estimation of integration in the study of opponents in Karate kumite with an integrative approach” (Daudinot, 2024).

The following theoretical foundations were assumed for the construction of the methodology for studying opponents in karate kumite:

From a philosophical perspective, the methodology was based on dialectical materialist theory, which linked theory and practice and considered coaches and karate practitioners as biopsychosocial subjects historically conditioned by socio-individualization processes.

From a sociological perspective, the role of the coach as a professional educator was highlighted, whose educational work was expressed in interactions both within and outside the training environment. These relationships, along with educational institutions and demographic factors, created a favorable environment for studying opposing forces through a dialectical dynamic that articulated individual and collective needs. The criteria of Barrios (2012), who emphasizes the coach's scientific preparation for fulfilling educational and social functions, were taken into account.

The analysis of social interactions between coaches and karate practitioners influenced the construction of knowledge and adaptation of strategies, key to understanding group dynamics and impact on kumite.

Regarding the psychological aspect, it was based on the historical-cultural theory of Vygotsky (1980) and his followers, highlighting two laws: the fundamental genetics of development, which pointed to the coach as a mediator in the internalization of knowledge and adaptation of strategies according to the zone of proximal development; and the dynamics of development, which recognized the integral personality of the karateka, formed by social interactions and the affective-cognitive unity, emphasizing communication and pedagogical mediation.

Similarly, the group and its higher state were transcendental: the group enhanced personal and professional growth through socio-historical interaction, facilitating reflection and mobilization of skills and values.

From a pedagogical perspective, the methodology drew upon Cuban educational tradition, emphasizing the need for coaches to clarify their pedagogical mission and address current challenges. It relied on theoretical frameworks regarding contextualization in social practice, valued within sports institutions. Authors such as Bermúdez and Rodríguez (1996), Bermúdez (2014), Addine (2002), De Armas (2004), Valle (2017), and Rice (2022) provided the foundation for this pedagogical theory, articulating ideas and concepts to analyze reality and its methodological implications.

For the methodological construction, the principles of Sagó (2006) cited by Milán (2021) were assumed:

- Principle of the activity: the process should be active, with coaches as protagonists through interaction and integration.
- Principle of motivation: it started from the coach's mastery to expand it progressively according to needs.
- Principle of interrelation: mutual learning between coaches, managers and colleagues through exchange and teamwork.
- Principle of purpose: fulfillment of instructional and educational objectives as a whole.
- Principle of safe orientation: concrete management of the interrelation process.
- Principle of rationality: coherent integration.

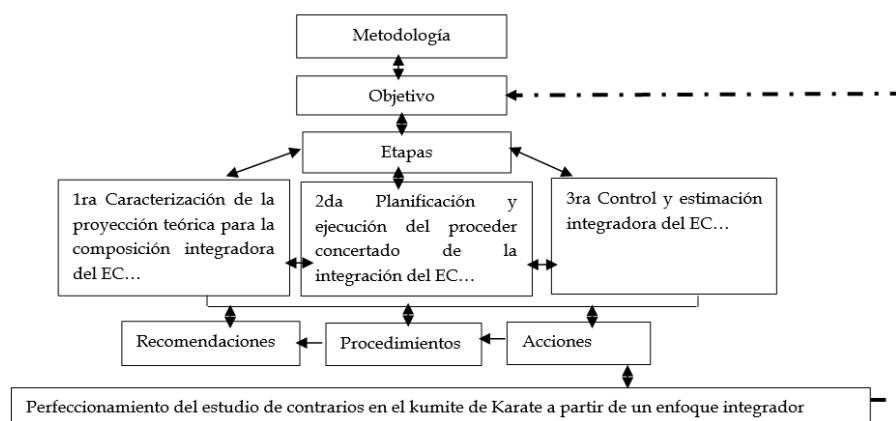
It was important to highlight that the methodology went through stages and a set of actions and activities in order to contribute to the study of opponents in karate kumite.

The stages were listed below:

- First: characterization of the theoretical projection and integrative composition for the study of opposites in karate kumite.
- Second: planning and execution of the concerted procedure of integration for the study of opponents in karate kumite.

- Third: control and integrative estimation of the study of opponents in karate kumite.

These stages of the methodology for studying opponents in karate kumite establish a dialectical and interdependent relationship; they fulfill the principles of systematicity and systemic character. These are embodied in the following scheme (Figure 1).



**Fig. 1.** - Graphic representation of the structure of the methodology for studying opponents in karate kumite.

**Source:** own elaboration

The following is a detailed presentation of the methodology for studying adversaries and its stages, actions, procedures, and recommendations.

*First stage: characterization of the theoretical projection for the integrative composition for the study of opposites in karate kumite*

In the first stage, a preliminary assessment of the human resources involved in implementing the proposal is conducted. This aims to characterize the level of knowledge of karate coaches, based on their theoretical understanding and the integrative approach necessary for their performance, including the study of opponents in karate kumite.

General actions of the stage:

1. Conduct a preliminary meeting with the various human resources that will be involved in the implementation of the proposal.
2. Development of instruments for the application of the comprehensive diagnosis that responds to the proposed objectives.
3. Application and tabulation of the comprehensive diagnosis (surveys, interviews and classroom observations) to the different human resources that will be involved in the materialization of the proposal.
4. Infer the regularities derived from the previous step and from these the protagonists who will intervene in this process will be trained.

The following procedures are identified as taking into account:

- Establish a conversation to obtain criteria about the level of willingness and commitment of Karate coaches in order to assume the theoretical projection and integrative composition of the contents of the study of opponents in kumite.
- Determine the regularities that constitute barriers to correcting mistakes.
- Investigate the characteristics of the coaches.

Recommendations:

- Conduct methodological work meetings.
- Employ participatory techniques in a group dynamic.
- Apply the assumed theory of studying opponents in karate kumite in accordance with the results of the diagnosis in order to ensure the execution of the following stages.



*Second stage: planning and execution of the concerted procedure for integration for the study of opponents in karate kumite*

This stage functions as an operational link between the initial diagnosis and subsequent actions, integrating theoretical and practical elements that allow for the improvement of the planning of the study of opponents in karate kumite.

It implements the projections and actions defined for the theoretical-methodological preparation of karate coaches for the execution of paths and procedures based on the integration of necessary content in professional performance during the study of opponents in karate kumite.

Following the diagnosis and the identification of weaknesses and strengths in the available knowledge for intervening in this process, this phase establishes methodological guidelines that include specialized theoretical training for coaches, the selection and design of tools for studying opponents in kumite, as well as the practical training required to apply these tools effectively.

General actions of the stage:

1. Organize a methodological meeting with the Karate coaches to explain the characteristics of the work to be carried out and to achieve greater clarity regarding the tasks to be undertaken.
2. Plan the different subsystems or organizational levels of methodological work based on the tasks for the study of opponents in karate kumite.
3. Development of the different methodological activities on the conceptualization of the different categories of the theoretical component and its content.
4. Methodological practical classes for studying opponents in karate kumite and their procedure using the system of indicators for studying opponents in karate kumite.

The following general procedures are proposed:

- Specify the content of the different types of activities and forms for the study of opponents in karate kumite.
- The indicators will be divided into several classes, as many as necessary for their optimal understanding.

The following requirements and recommendations are taken into account to carry out this training:

**Requirements:** Consider the diversity and particularities of coaches and karate practitioners, ensuring mastery of sports intelligence, theoretical and methodological foundations. Furthermore, anticipate trends of change to transform the object of study and evaluate the coaches' willingness to engage in the research process.

**Recommendations:** It is suggested to use validated instruments and analyze the results of classroom observations and technical meetings to identify training needs in the study of opponents in kumite. This will allow for the coordination of actions with future stages and ensure continuity, achieving an adequate theoretical and procedural level in the study of opponents in karate kumite.

*Third stage: control and integrative estimation of the study of opponents in karate kumite*

This stage involves integrative workshops for karate coaches to discuss, analyze, and overcome limitations, reinforcing their theoretical knowledge and evaluative skills. These workshops allow for adjustments to the training process, promoting teamwork and consolidating competencies in analyzing opponents during karate kumite.

To ensure the coherence of these activities, it is essential to detail each of the proposed actions, along with the methodological mechanisms that support them.

General actions of the stage:

1. To evaluate, from an anticipated, mobilizing, transformative and contextual perspective, the issues for their treatment in certain circumstances.

2. Conduct observations of the classes, to monitor and assess the effectiveness of the study of opponents in karate kumite for karatekas.
3. Develop methodological preparations to provide feedback and correct the deficiencies detected.
4. Conduct integrative workshops analyzing which participatory techniques to apply that allow the assumption of positions to be argued and evaluations to be offered.

The aforementioned integrative workshops will follow an introduction, development, and conclusion structure, guided by a facilitator who will explain each phase to ensure the understanding and effective application of the proposal in the study of opponents in karate kumite. These instructional workshops were implemented during coach training, covering essential theoretical foundations and procedures. Finally, an evaluation workshop will be held, with a selected speaker (the researcher), to demonstrate the development of the opponent study with an integrative approach.

#### Recommendations:

It is necessary to create a favorable climate of commitment and support, considering personal and professional needs, so that the coach can apply the appropriate theory and teaching resources, fostering a positive attitude during training and the implementation of the study of opponents in kumite.

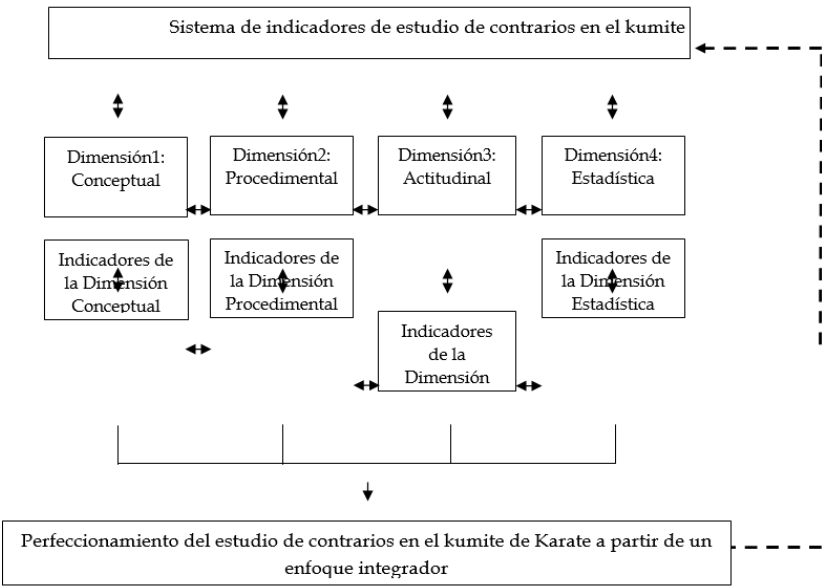
The proposed methodology reaches its maximum effectiveness when complemented by a system of specific indicators for studying opponents in karate kumite. In current literature, Daudinot & Puente (2022) present indicators for the technical-tactical study of the opponent in karate kumite, which are processed using an observation protocol form for studying the opponent.

This proposed set of indicators aims to identify negative technical aspects in opposing teams. The authors suggest that observations be conducted by four observers throughout the year, across all competitions.

Indicators to be evaluated:

1. Hashime out of combat.
2. Kamaite position.
3. Displacements.
4. Technique used to mark senshu.
5. Technical strength.
6. Technical weakness.
7. Types of dodges he performs against attacks with both his legs and arms.
8. Other techniques he performs.
9. Identify facial or body gestures.
10. Deceptions he uses.
11. Negative habits.
12. Offensive characteristics.
13. Defensive characteristics.
14. When he wins, he does what he wants.
15. When he loses what he does.
16. Behavior in the first minute of combat.
17. Behavior in the second minute of combat.
18. Behavior in the third minute of combat.

These indicators represent an important precedent in the literature on the study of opponents in karate kumite; however, in the opinion of the author of this research, they are insufficient for the level of information sought from each opponent. It is suggested that the development of this new system of indicators for studying opponents in karate kumite encompass four interrelated dimensions, explained below and illustrated in Figure 2 and Table 1.



*Fig. 2. - Representation of the internal relationships of the system of indicators for studying opponents in karate kumite.*  
*Source: own elaboration.*

*Table 1. - General examples of the characteristics of the dimensions and their indicators*

Dimension	Description	Examples of indicators
Conceptual	Cognitive elements performed during combat by karate practitioners.	Adaptability to strategies and tactics.
Procedural	Procedures and techniques applied during observation and analysis.	Record of techniques used, dodges, positions.
Attitudinal	Behaviors, different physical and psychological abilities and motivations of the karateka.	Emotional management, physical abilities with greater and lesser development.
Statistics	Quantitative data on each attack, penalties and displacements derived from systematic observation and analysis of combats.	Frequency of techniques, effectiveness, patterns.

*Source: own elaboration.*

The graphical representation (Figure 2) illustrates how the four dimensions must converge systemically in the study of opposites. Bidirectional arrows show feedback between them: statistical data (dimension 4) modify procedural data (dimension 2), while attitudes (dimension 3) condition conceptual assimilation (dimension 1), but in

turn, conceptual, procedural, and attitudinal data offer the necessary context for the deep interpretation of the statistics, characterizing each element of it.

The development of this new system of indicators will allow the identification and quantification of relevant aspects to observe in the opponent, facilitating the obtaining of accurate and structured information.

This research revealed several fundamental aspects for the study of opponents in karate kumite, integrating theoretical and methodological foundations that align with existing scientific literature. Unlike other fragmented observational tools that focus on isolated technical indicators, this research proposed complementing the developed methodology with a more comprehensive system of indicators.

To this end, the need arose to develop a system of indicators that includes conceptual, procedural, attitudinal, and statistical dimensions, thus overcoming limitations in the depth and systematicity of observation. This established the path for future research, which ultimately optimized the study of opponents in karate kumite.

The three-stage methodological design—characterization, planning, execution, and control (Milan, 2022)—demonstrates coherence with the principles of dynamic systems described in previous studies on sports intelligence. Furthermore, the incorporation of Marxist philosophical foundations and Vygotsky's sociocultural theory (1980) strengthened the socio-historical and pedagogical contextualization, an aspect that has been underdeveloped in previous studies, which focus primarily on technical or tactical aspects without integrating the coach's formative dimension.

As limitations and pending challenges, it was observed that fundamental gaps persist that require future attention.

1. The proposed system of indicators still requires development and its corresponding validation, to ensure its applicability in different competitive contexts and technical levels.

2. The lack of theoretical systematization could be solved through a unified theoretical-methodological conception that integrates the proposed system of indicators with contemporary pedagogical models.
3. Technological integration for the computerization and automation of data analysis was not developed in this phase, which limits scalability and speed of feedback.
4. The limited sample size and geographical scope restrict the generalizability of the results, suggesting the need for multicenter and transdisciplinary studies.

These limitations coincide with methodological challenges identified in instrumental validation studies, particularly regarding scalability and objectification of evaluative criteria.

As practical implications, the methodology offers three concrete contributions to the field of karate.

- For coaches: It provides a standardized protocol for studying opponents and contextualized action plans.
- For sports institutions: it suggests a replicable model of continuous training based on diagnostic-intervention-evaluation cycles.
- For researchers: It establishes methodological parameters for comparative studies, particularly in tactical analysis.

Based on the limitations and findings of this research, the following specific recommendations are proposed:

1. Transdisciplinary development and validation of the indicator system: It is necessary to conduct multicenter studies with a mixed approach (qualitative and quantitative) to adjust and validate the effectiveness of the system in various contexts and levels of competence, taking into account the current limitation of empirical validation.

2. Design of an integrated theoretical-methodological conception in computational models:

Given the lack of implemented technological tools, it is recommended to develop computational models that integrate the philosophical, psychological and pedagogical dimensions, facilitating the automation of analysis and real-time decision-making.

3. Advanced technological implementation for the study of opponents:

Following current trends in modern sports and sports intelligence, it is suggested to incorporate specialized software, artificial intelligence and video analysis systems to optimize observation and feedback, improving the efficiency and accuracy of the study of opponents.

4. Greater sample selectivity and geographical reach:

To improve the generalizability of the results, it is recommended to expand the sample to include the five Cuban provinces that have historically ranked highest in the national Karate rankings, as well as the national team. This will allow for the validation of the methodology in diverse contexts and strengthen its practical applicability.

These proposals align with the technological demands prioritized by the National and Provincial Directorate of Sports in Guantánamo, the National Karate-do Federation and the Scientific Council of karate sport in the territory, responding to the problems evidenced in the sports intelligence process and the need to improve the study of opponents in kumite from an integrative approach.

## **CONCLUSIONS**

The research enabled the development and validation of a methodology for studying opponents in karate kumite, supported by an integrated system of indicators that considers multiple dimensions, thus overcoming the limitations of previous fragmented



tools. This allows for improved training quality and better management of opponent analysis, thereby contributing to the refinement of sports intelligence in Cuban karate.

The application of the mixed quasi-experimental design, with phases of diagnosis, implementation and evaluation, facilitated the identification of deficiencies in the knowledge and practice of coaches and karate practitioners, as well as the subsequent training and improvement in the study of opponents, evidenced in the technical-tactical performance of the athletes.

It was found that the lack of theoretical systematization and the limited technological integration restrict the effectiveness of the study of opposites, so it is recommended to continue the development and validation of the indicator system, as well as to incorporate computational tools and advanced software for the automation of analysis and feedback.

The sample and the restricted geographical scope constitute a limitation for the generalizability of the results, so it is suggested to expand the research to other provinces and the national selection, strengthening the practical applicability and validation in diverse contexts.

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***Conflict of interest:***

The authors declare no conflict of interest.

***Authors' contributions:***

**Edsnel Eugenio Daudinot Llibre:** conception of the idea, literature search and review, instrument development, general advice on the topic addressed, drafting of the original (first version), revision and final version of the article, authorship coordinator.

**Fernando Puente Gamboa:** creation of tables, graphs, and images, application of instruments, translation of terms or information obtained, proofreading of the article, compilation of information resulting from the applied instruments, statistical analysis, review of the application of the bibliographic style guide.

**Eudis Milán Leyva:** statistical analysis, proofreading of the article.



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