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Research designs in Sports Science

Diseños de investigación en Ciencias del Deporte

Desenhos de investigação em Ciências do Desporto

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Abstract

Research design constitutes a core component of the scientific process, as it structures the logical coherence among the theoretical framework, methodological decisions, data collection and analysis, and the interpretation of results. However, in Sport Sciences, conceptual ambiguity persists in the use of terms such as methodology, design, method, and instruments, along with a frequent lack of explicit identification of the adopted design in numerous studies. The aim of this article is to clarify the conceptual role of research design within the research process and to propose an original, comprehensive, and flexible classification specifically tailored to the field through a narrative review. To this end, the relationship among methodology, design, method, and techniques/instruments is hierarchically delineated, and an integrative framework of six broad study types is presented: methodological, theoretical, and instrumental designs, and empirical designs (quantitative, qualitative, and mixed methods). The proposal conceives design as a multidimensional and non-exclusive structure, in which different criteria can coexist and be integrated within a single study depending on the objectives, context, and analytical strategy. This approach facilitates the identification, communication, and evaluation of research design, and supports the recommendation of systematically reporting it as a specific subsection within the methods section to strengthen transparency, replicability, and research quality in Sport Sciences.

Keywords: research methodology; research design classification; methodological designs; theoretical designs; instrumental designs; quantitative empirical designs; qualitative designs; mixed methods design.

Resumen

El diseño de investigación constituye un componente nuclear del proceso científico, al estructurar la coherencia lógica entre el marco teórico, las decisiones metodológicas, la recogida y el análisis de los datos y la interpretación de los resultados. Sin embargo, en las Ciencias del Deporte persiste una ambigüedad conceptual en el uso de términos como metodología, diseño, método e instrumentos, así como una frecuente falta de explicitación del diseño adoptado en numerosos trabajos. El objetivo de este artículo es clarificar el papel conceptual del diseño de investigación dentro del proceso investigador y proponer una clasificación original, integral y flexible específicamente adaptada al área mediante una revisión narrativa. Para ello, se delimita jerárquicamente la relación entre metodología, diseño, método y técnicas/instrumentos, y se presenta un marco integrador de seis grandes tipos de estudios: diseños metodológicos, teóricos e instrumentales, y diseños empíricos (cuantitativos, cualitativos y mixtos). La propuesta concibe el diseño como una estructura multidimensional y no excluyente, en la que distintos criterios pueden coexistir e integrarse dentro de un mismo estudio en función de los objetivos, el contexto y la estrategia analítica. Este enfoque favorece la identificación, comunicación y evaluación del diseño de investigación, y respalda la recomendación de explicitarlo sistemáticamente como una subsección específica dentro del apartado de metodología para reforzar la transparencia, la replicabilidad y la calidad de la investigación en Ciencias del Deporte.

Palabras clave: metodología de investigación; clasificación de diseños; diseños metodológicos; diseños teóricos; diseños instrumentales; diseños empíricos cuantitativos; diseños cualitativos;

diseños mixtos

Resumo

O desenho de investigação constitui um componente nuclear do processo científico, ao estruturar a coerência lógica entre o enquadramento teórico, as decisões metodológicas, a recolha e a análise dos dados e a interpretação dos resultados. No entanto, nas Ciências do Desporto persiste uma ambiguidade conceptual no uso de termos como metodologia, desenho, método e instrumentos, assim como uma frequente falta de explicitação do desenho adotado em numerosos trabalhos. O objetivo deste artigo é clarificar o papel conceptual do desenho de investigação dentro do processo investigador e propor uma classificação original, integral e flexível especificamente adaptada à área mediante uma revisão narrativa. Para tal, delimita-se hierarquicamente a relação entre metodologia, desenho, método e técnicas/instrumentos, e apresenta-se um quadro integrador de seis grandes tipos de estudos: desenhos metodológicos, teóricos e instrumentais, e desenhos empíricos (quantitativos, qualitativos e mistos). A proposta concebe o desenho como uma estrutura multidimensional e não excludente, na qual distintos critérios podem coexistir e integrar-se dentro de um mesmo estudo em função dos objetivos, do contexto e da estratégia analítica. Esta abordagem favorece a identificação, comunicação e avaliação do desenho de investigação, e respalda a recomendação de o explicitar sistematicamente como uma subsecção específica dentro do apartado de metodologia para reforçar a transparência, a replicabilidade e a qualidade da investigação em Ciências do Desporto.

Palavras-chave: metodologia de investigação; classificação dos desenhos de investigação; desenhos metodológicos; desenhos teóricos; desenhos instrumentais; desenhos empíricos quantitativos; desenhos qualitativos; desenhos mistos.

Introduction

Research design represents the initial conceptual phase of the methodological process and refers to the overarching plan that governs data collection, analysis, and interpretation in scientific inquiry (Hernández et al., 2014; Polit & Hungler, 2000). It can be defined as a logical and coherent framework that enables researchers to integrate the different stages of a study so that the resulting findings are valid, reliable, and generalisable (Ato et al., 2013). Beyond delineating the research strategy, whether experimental, quasi-experimental, correlational, descriptive, or qualitative, design also determines key procedural elements, including participant selection, control of extraneous variables, and the choice of analytical techniques (Gratton & Jones, 2014). As noted by Montero and León (2007), research design must directly address the study objectives and be aligned with the empirical conditions of the research problem, ensuring consistency between the theoretical framework and the operationalisation of variables. From this standpoint, a well-formulated design is not merely a technical requirement but an epistemological foundation that underpins the quality of the knowledge produced (Polit & Hungler, 2000).

Given the polysemous nature of the term, research design may be conceptualised from several complementary perspectives: as the set of decisions adopted during the planning phase of a study (Ranganathan & Aggarwal, 2018); as a system of rules guiding the researcher in obtaining systematic and uncontaminated observations of relationships between variables (Rezigalla, 2020); or as an overarching strategy intended to answer research questions while controlling different sources of variance (Graham et al., 2020). In this latter sense, design is grounded in the MAXMINCON principle, which seeks to maximise primary variance (systematic variance), minimise error variance, and control secondary variance (extraneous variance) (Cubo et al., 2011).

The complexity of the phenomena examined in Sport Sciences renders the classification of research designs inherently multidimensional and dependent on multiple criteria (Graham et al., 2020). Designs do not constitute mutually exclusive categories; rather, they may be combined according to the specific requirements of a given study (Ranganathan & Aggarwal, 2018). Accordingly, their appropriate application requires explicit identification of the criterion underlying their classification, acknowledging the validity and complementarity of different methodological perspectives.

In this regard, Cubo et al. (2011) propose classification criteria based on the methodological approach adopted, the type of information generated, the degree of experimental control, the number of variables considered, and the organisation of groups.

Research design should therefore be understood as a strategic decision embedded within a systematic research process, in which the different phases of the study, from problem formulation to data analysis and interpretation (Blair et al., 2019), are coherently articulated rather than treated as isolated sequential steps. Gratton and Jones (2014) describe this process as comprising eight principal stages: topic selection, literature review, development of the epistemological component of the theoretical-conceptual framework, formulation of the research question or hypothesis, study design, data collection, data analysis, and conclusion drawing. Within Sport Sciences, this structured progression is essential to ensure alignment between the theoretical framework, methodological decisions, and interpretation of findings, thereby strengthening the validity and overall quality of the knowledge generated (Thomas et al., 2015). Although often presented in a linear sequence, these phases typically involve iterative adjustments and feedback loops across stages.

In this context, research design should not be viewed as a purely technical choice or as a final methodological label. Rather, it constitutes a structural element that shapes the internal logic of the study, the nature of the data collected, and the scope of subsequent analysis and inference. Adopting this process-oriented perspective is particularly pertinent in Sport Sciences, where the complexity of research settings and the diversity of methodological approaches demand explicit alignment between research objectives, design decisions, and interpretation of results.

From this standpoint, the present article is conceived as an original methodological reference framework aimed at clarifying, systematising, and guiding the accurate identification and reporting of research designs in Sport Sciences. Specifically, we propose an integrative, flexible, and non-exclusive classification of research designs that coherently organises the principal types of studies conducted in the field, namely theoretical, methodological, instrumental, and empirical designs, while allowing for their combination and integration according to the research problem, applied context, and stated objectives.

Methodology, Research Design, Methods, and Instruments

Within Sport Sciences research, a substantial proportion of methodological imprecision in scientific publications stems from the interchangeable use of terms that correspond to distinct decision-making levels within the research process (Polit & Hungler, 2000). This conceptual ambiguity has been widely acknowledged in contemporary interdisciplinary methodological literature, which emphasises the need to clearly distinguish between strategic, operational, and technical levels of inquiry (Varghese et al., 2025). In particular, concepts such as *methodology, research design, method, and research instruments* are frequently treated as synonyms, despite fulfilling specific and non-interchangeable functions in the planning, execution, and reporting of a study, and despite reflecting a differentiated hierarchical structure.

At the *macro* level lies methodology, understood as the system of principles, conceptual foundations, and underlying logic that guide the overall research process (Mozolev & Polishchuk, 2024). At the *meso* level, research design constitutes the fundamental structural framework of the study, responsible for organising in a coherent and temporally ordered manner the decisions required to address the research questions (Tobi & Kampen, 2018). The *micro* level corresponds to the method, defined as the articulated set of procedures employed to generate and analyse data (Poucher et al., 2019). Finally, the *technical* level comprises the specific instruments and tools used for measurement or data collection (Tobi & Kampen, 2018).

Figure 1 summarises this hierarchical delineation of the principal decision-making levels structuring the research process in Sport Sciences. Such differentiation clarifies the scope and specific function of each construct, preventing indiscriminate use and promoting coherent methodological planning, as well as more precise and transparent scientific reporting.

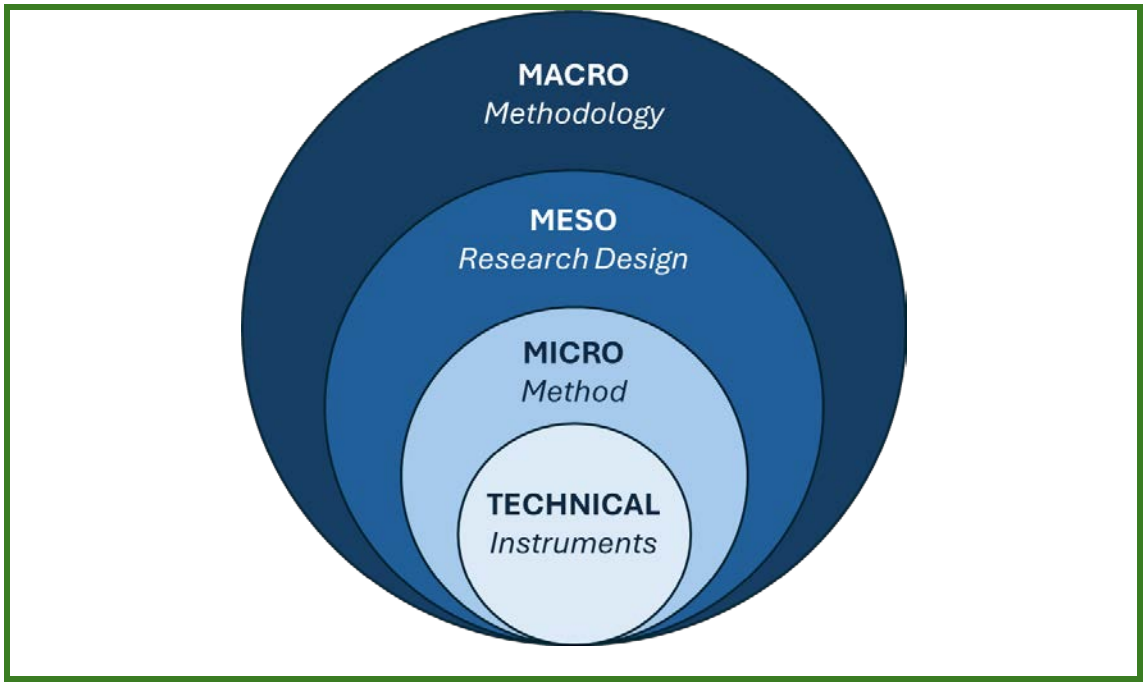

Figure 1. Hierarchical levels of the research process in Sport Sciences

Accordingly, the first step is to systematically clarify these four constructs by delineating their conceptual scope and operational role. The aim is to provide researchers with a comprehensible and applicable framework that reduces ambiguity and facilitates rigorous methodological reporting. In this context, research design should be understood as the logical framework that organises and confers coherence on the entire research process, whereas methods and techniques represent operational decisions subordinate to that framework, selected according to the study objectives, contextual constraints, and the nature of the phenomenon under investigation (O'Donoghue, 2010).

At the highest hierarchical level (Macro level) lies research methodology, conceived as the overarching reference framework that guides and justifies the decisions adopted throughout the research process (Mozolev & Polishchuk, 2024). From this perspective, methodology extends beyond merely describing procedures (i.e., answering the question *what will be done?*); rather, it critically examines and justifies why specific methodological options are selected in light of the research problem and study objectives, taking into account the theoretical and epistemological assumptions underpinning them (Hernández et al., 2014). Methodology thus functions as an integrative layer that ensures internal coherence across methodological decisions, consistently articulating research design, method, and techniques or instruments, and contributing to clearer and more systematic scientific communication (Indu & Vidhukumar, 2020; Sharma, Jha, et al., 2023).

At the second hierarchical level (Meso level) is research design, defined as the structured plan of action aimed at generating relevant information to address the scientific problem (Tobi & Kampen, 2018). Research design may be conceptualised as the preconceived general framework or scheme for investigating a scientific problem, acting as an integrative strategy that provides logical coherence and specific direction to the project (Indu & Vidhukumar, 2020; Sharma, Jha, et al., 2023; Varghese et al., 2025). It establishes the global logical and strategic architecture of the study, defining how the investigation is organised to address the stated questions or objectives while safeguarding internal and external validity. The concept encompasses a dual meaning: on the one hand, the process of designing, the intellectual activity of conceiving and planning the study; on the other, design as a product, namely the resulting structural plan or *blueprint* that coherently integrates all components of the investigation (Polit & Hungler, 2000; Schoonenboom & Johnson, 2017). Its primary function is to ensure that these components interact effectively to answer the research question through optimal control of variables, while also accounting for practical constraints such as time, financial

resources, and accessibility inherent to the research context (Hakim, 2000). Operationally, research design fundamentally addresses the question: *how will the problem be studied?*

A robust design is inherently multidimensional and is constructed through interrelated decisions concerning study purpose, theoretical drive, temporality, integration points, and the overall complexity of the methodological approach. Crucially, it is the research problem that determines the appropriate type of design, qualitative, quantitative, or mixed methods (Armour & MacDonald, 2012), and not vice versa (Indu & Vidhukumar, 2020). Within this framework, design encompasses key decisions regarding study type (experimental, quasi-experimental, or observational), degree of variable control (manipulation, randomisation, or group comparison), temporality (cross-sectional or longitudinal), data collection setting (field, laboratory, or competition), and overall analytical orientation. Moreover, a single study may be simultaneously characterised using non-mutually exclusive descriptors, such as prospective or retrospective, and cross-sectional or longitudinal, depending on whether data are newly collected or pre-existing and whether assessment occurs at a single time point or repeatedly over time (Andrade, 2019). These decisions aim to legitimise multiple forms of validity and ensure the reliability of findings, always within the practical constraints inherent to Sport Sciences research.

At the third hierarchical level (Micro level) is the research method, referring to the general empirical strategy through which the design is operationalised (Poucher et al., 2019). n research articles, the method is typically detailed within the procedure section. The method comprises the set of specific procedures, sequential steps, and operational tools employed to execute data collection, measurement, analysis, and interpretation within the framework established by the research design (Indu & Vidhukumar, 2020; Sharma, Jha, et al., 2023). Whereas design represents the macro-level strategic roadmap of the study, the method reflects an operational and functional logic, addressing the question: *through which procedures and techniques will the problem be examined?*

Methods function as subordinate instruments that materialise the design's planning through concrete approaches, such as clinical trials, cohort studies, surveys, systematic observations, or in-depth interviews. Method selection constitutes a technical decision oriented toward generating relevant information and is linked to the degree of researcher intervention. Accordingly, strategies may be classified as observational, descriptive, analytical, or experimental/interventionist, depending on whether study variables are manipulated (Indu & Vidhukumar, 2020). From an operational standpoint, the method integrates decisions concerning data collection techniques, instruments and devices employed, measurement procedures and protocols applied, as well as data analysis techniques. Within mixed-methods research, the method is particularly reflected in integration or expansion points, where qualitative and quantitative components are purposefully combined to enhance depth, breadth of understanding, and corroboration of findings (Schoonenboom & Johnson, 2017).

Finally, at the most operational tier lies research techniques and instruments (Technical level), referring to the specific procedures used for data acquisition, recording, and analysis throughout the research process (Tobi & Kampen, 2018). This level encompasses decisions related to sampling, information gathering, variable measurement, and data analysis, thereby enabling the practical implementation of the method within the framework established by the research design. In Sport Sciences, these techniques are commonly operationalised through the use of specific technological and methodological tools, such as GPS/LPS tracking systems for external load monitoring, force platforms for neuromuscular assessment (Ferraz et al., 2023), validated questionnaires for the measurement of psychological constructs, systematic observational coding of motor behaviour, or standardised physiological testing protocols (Anguera & Hernández-Mendo, 2013). However, these instruments lack methodological meaning if applied in isolation, as their validity and utility depend on coherence with the selected method and the overarching research design that integrates them. The principal contemporary challenge is therefore not the availability of technology per se, but rather the rigorous standardisation and validation of procedures and metrics, together with their coherent alignment with research and applied questions.

From this hierarchical perspective, methodology provides the overarching reflective and justificatory framework; design strategically structures the study; method defines the general mode of empirical execution; and techniques

operationalise the research in practice (Table 1). This differentiation is particularly critical in Sport Sciences, where the complexity of research settings and the proliferation of technological tools increase the risk of conceptual confusion unless the distinct methodological decision levels are explicitly articulated.

Table 1. Methodology, Research Design, Method, and Research Techniques in Sport Sciences

Aspect	Methodology	Research Design	Research Method	Techniques / Instruments
Level	Macro	Meso	Micro	Technical
Hierarchy	Meta-methodological	Strategic and conceptual	General operational	Specific operational
Primary function	Analyse and justify methodological decisions	Logically structure the study	Execute the empirical strategy	Apply specific procedures
Key question	*Why is the study conducted in this way?*	*How will the study be organised?*	*How will it be executed empirically?*	*Which tools will be used to obtain the data?*
Role in the research process	Overarching reflective framework	Structural plan of the study	Empirical action strategy	Operational implementation of the method
Hierarchical relationship	Integrative upper level	Subordinate to methodology	Subordinate to design	Subordinate to method
Examples in Sport Sciences	Quantitative methodological approach	Randomised experimental design	Experimental method with control and intervention groups	Standardised physical tests, validated inertial devices, statistical software
	Qualitative methodological approach	Phenomenological design	In-depth interview method	Semi-structured interview guide, digital recording, thematic analysis software
	Mixed-methods methodological approach	Explanatory sequential design (QUAN→QUAL)	Combined method: statistical analysis followed by explanatory interviews	Validated questionnaires, physical testing, semi-structured interviews, data integration through joint display matrices

This hierarchical delineation enables research in Sport Sciences to be understood as a system of interrelated and coherent decisions, in which each level fulfils a specific and non-substitutable function (Polit & Hungler, 2000). Confusion between methodology, design, method, and instruments not only undermines the quality of scientific reporting but also hampers critical appraisal and limits the replicability of findings. Accordingly, the conceptual clarification presented in this section should not be interpreted as merely terminological exercise, but rather as a necessary condition for rigorous planning, methodologically consistent execution, and precise scientific communication.

This framework is particularly pertinent in a field characterised by heterogeneous research contexts, diverse methodological approaches, and rapidly evolving technological tools. It provides the conceptual foundation upon which the proposed classification of research designs, developed in the following sections, is constructed (Armour & MacDonald, 2012).

Methodology

Objectives

The primary objective of this article was to clarify the conceptual role of research design within the scientific process in Sport Sciences, delineating its hierarchical relationship with methodology, method, and techniques/instruments, and to propose an original, comprehensive, flexible, and non-exclusive classification of the principal research designs, specifically adapted to the epistemological and applied particularities of the field.

This overarching aim was operationalised through the following specific objectives: i) To define and differentiate, from both conceptual and applied perspectives, the meaning and scope of the terms *methodology*, *design*, *method*, and *techniques/instruments*, identifying common sources of ambiguity and their implications for scientific communication; ii) To establish a hierarchical framework of methodological decision-making that situates research design as a structuring

element, thereby facilitating its explicit and systematic identification and reporting; iii) To integrate and systematise the relevant methodological literature in order to underpin a classification proposal consistent with the actual use of research designs in Sport Sciences; iv) To present an integrative framework that organises research designs by describing their distinctive criteria and their logic of compatibility; v) To propose guidelines for the identification and classification of research design in scientific manuscripts, enhancing methodological transparency, interpretability, and replicability within the field.

Design

The present study is conceived as a methodological investigation focused on theoretical grounding and classificatory systematisation, aimed at conceptual clarification and the development of an integrative framework of research designs in Sport Sciences. It is classified as a narrative-analytical theoretical design (Ato et al., 2013), insofar as its primary purpose is not the generation of original empirical data, but rather the critical analysis, conceptual delimitation, and structured integration of existing methodological knowledge. This process was oriented toward the synthesis and systematic reorganisation of prior contributions drawn from general and sport-specific methodological manuals, as well as from relevant peer-reviewed scientific literature.

Procedure and Criteria for Theoretical Grounding

The procedure followed in the development of this article was structured into three successive phases: (a) identification and analysis of relevant methodological literature; (b) conceptual delimitation and terminological hierarchisation; and (c) construction and integration of the classificatory system.

In the first phase, widely recognised research methodology manuals and key reference works used in Sport Sciences, Biomedical Sciences, and Applied Social Sciences were reviewed. Particular attention was given to proposals addressing the differentiation between methodology, design, method, and techniques/instruments, as well as to prior classifications of empirical designs. Sources were selected according to criteria of academic relevance, recognition within the specialised literature, and applicability to the sport research context.

In the second phase, a comparative analysis was conducted to identify conceptual convergences, divergences, and gaps. This process enabled the establishment of a hierarchical delineation of methodological decision levels and clarified the specific status of research design within the scientific process.

Finally, the classificatory proposal was developed through a process of systematic integration, guided by criteria of internal logical coherence, non-exclusivity between categories, multidimensional compatibility, and practical utility for the identification and reporting of research design in Sport Sciences studies.

Research Designs

According to their *methodological orientation*, research designs can be classified as quantitative, qualitative, or mixed methods (Creswell, 2009; Hernández et al., 2014; Varghese et al., 2025). Quantitative designs are grounded in the collection and analysis of numerical data with the aim of testing hypotheses, examining relationships between variables, and generalising findings through standardised measurement techniques and statistical procedures (Nelson et al., 2014). This category includes, among others, experimental, quasi-experimental, survey, and correlational designs (Polit & Hungler, 2000; Sharma, Jha, et al., 2023).

In contrast, qualitative designs focus on the collection and analysis of non-numerical data, such as words, images, sounds, or observational records (Hernández et al., 2014), with the purpose of exploring and understanding the meanings, experiences, and processes that individuals or groups attribute to a given phenomenon, while emphasising the contextual conditions in which it occurs (Polit & Hungler, 2000; Thomas et al., 2015). Common qualitative

approaches include case study, ethnography, phenomenology, grounded theory, and narrative analysis (Sharma, Jha, et al., 2023).

Finally, mixed-methods designs intentionally combine quantitative and qualitative components within a single study, integrating both types of data at one or multiple stages of the research process in order to broaden, complement, or deepen understanding of the phenomenon under investigation (Camerino et al., 2014; Creswell, 2009). From this perspective, mixed-methods designs may adopt either concurrent or sequential structures, giving rise to configurations such as convergent parallel, explanatory sequential, exploratory sequential, embedded, transformative, or multiphase designs (Sharma, Jha, et al., 2023).

Table 2 provides a comparative synthesis of the principal epistemological, methodological, and analytical characteristics associated with quantitative, qualitative, and mixed-methods approaches (Thomas et al., 2015). Its purpose is to offer a general reference framework for contextualising different research designs, without implying mutually exclusive categories or exhausting the diversity of combinations that may emerge in Sport Sciences research practice.

Table 2. General Characteristics of Quantitative, Qualitative, and Mixed-Methods Approaches in Research

Aspect	Quantitative Research	Qualitative Research	Mixed-Methods Research
Nature of data	Numerical, measurable data	Descriptive, textual, and narrative data	Numerical and non-numerical data
Conception of reality	Objective, singular, and observable reality	Subjective, multiple, and socially constructed reality	Reality understood from multiple perspectives
Context	Aims to generalise findings across contexts	Focuses on understanding phenomena within their specific context	Integrates contextual understanding with potential for generalisation
Primary objective	Measure, describe, and establish causal relationships	Understand meanings, experiences, and processes	Broaden and deepen understanding by combining approaches
Sample size and type	Large samples, statistically selected	Small samples or individual cases selected purposively	Samples defined according to the quantitative and/or qualitative phase
Role of the researcher	Neutral observer external to the phenomenon	Active participant interpreting from within	Flexible role depending on the study phase
Data collection instruments	Questionnaires, tests, standardised scales	Interviews, focus groups, participant observation	Combined quantitative and qualitative instruments
Research setting	Controlled or artificial	Naturalistic and everyday settings	Varies according to the study component
Data analysis	Statistical, inferential	Interpretive, inductive, thematic or narrative analysis	Integrated statistical and interpretive analysis
Philosophical foundation	Positivism	Interpretivism or constructivism	Pragmatism
Logical approach	Deductive: derived from theory or hypothesis testing	Inductive: theory generated from observation	Deductive, inductive, or combined
Design temporality	Typically cross-sectional or longitudinal	Flexible and emergent	Concurrent or sequential
Quality criteria	Internal and external validity, reliability, bias control, statistical power	Credibility, transferability, dependability, confirmability	Credibility, transferability, dependability, confirmability

Note. Within each methodological approach, study quality should be assessed using approach-specific criteria, such as validity and reliability in quantitative research; credibility and transferability in qualitative research; and coherent integration and methodological rigour across both strands in mixed-methods research.

The selection among these three principal categories is not arbitrary; rather, the research problem determines the most appropriate type of design to address the phenomenon under investigation (Indu & Vidhukumar, 2020). However, although this differentiation based on methodological orientation is necessary as an initial step, it is insufficient to accurately capture the complexity of research designs in Sport Sciences (Andrade, 2019). Beyond the type of data collected or the predominant analytical logic, characterising a design requires consideration of traditional classification criteria, such as data collection temporality, degree of experimental control, number of variables, and mode of group organization, as well as cross-cutting criteria, including ecological data collection context, degree of researcher

intervention, source of information, unit of analysis, and degree of standardisation or flexibility. These dimensions enable a more precise and operational identification of studies, refine their inferential scope, and clarify their ecological validity and practical applicability.

These criteria demonstrate that the classification of research designs in Sport Sciences follows a multidimensional logic grounded in interrelated methodological decisions rather than a unidimensional or strictly hierarchical structure. Figure 2 summarises the principal cross-cutting criteria that allow research designs in Sport Sciences to be described and characterised from a multidimensional perspective, thereby facilitating more accurate identification of the design adopted according to the methodological decisions involved. These criteria do not represent mutually exclusive or hierarchical categories; instead, they function as complementary axes through which a single study may be simultaneously defined (Cubo et al., 2011; Polit & Hungler, 2000).

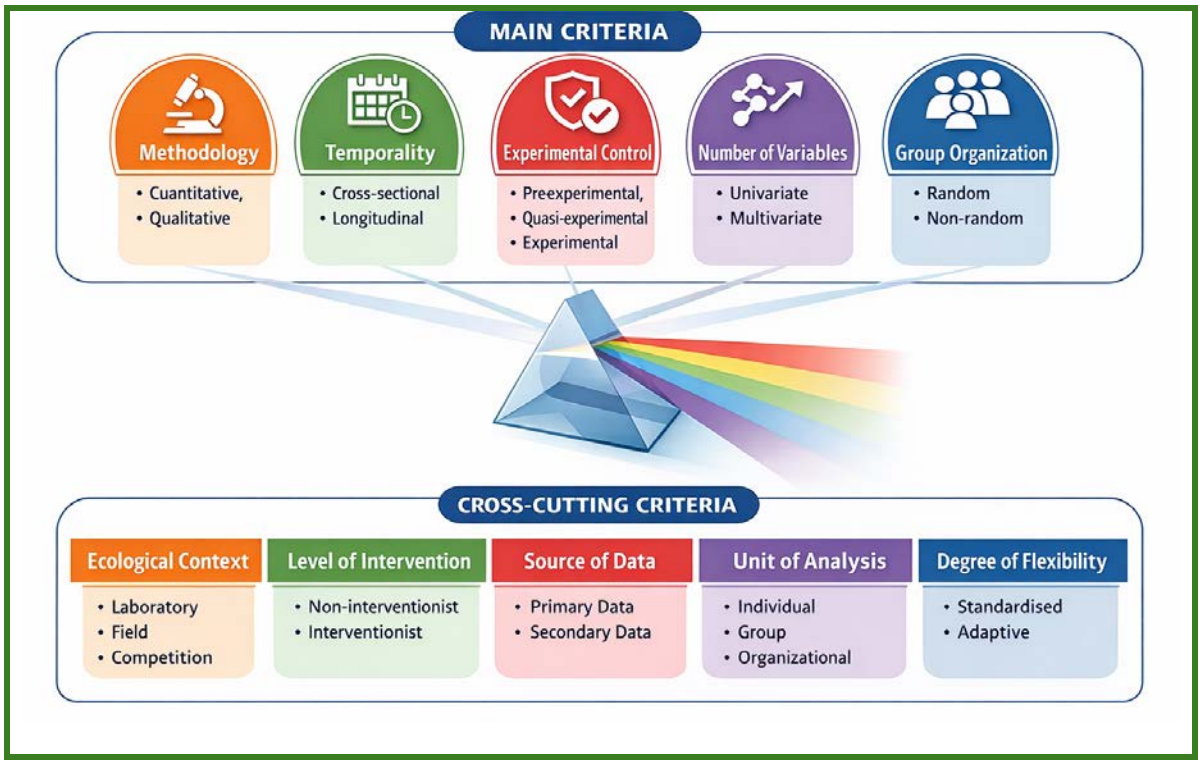

Figure 2. Multidimensional criteria for the classification of research designs in Sport Sciences.

Considering the temporality of data collection, designs may be classified as cross-sectional, when information is obtained at a single time point, or longitudinal, when measurements are collected across multiple time points (Creswell, 2009; Cubo et al., 2011; Manterola & Otzen, 2014). This decision is directly aligned with the study objective, whether to describe a specific situation or to analyse its evolution over time.

With respect to *internal validity and degree of researcher intervention*, research designs may be categorised as pre-experimental, quasi-experimental, or experimental (Shadish et al., 2002). Pre-experimental designs involve limited control of extraneous variables, thereby restricting causal inference. Quasi-experimental designs include manipulation of the independent variable but lack full experimental control, typically due to constraints in random assignment. Experimental designs, by contrast, implement rigorous control procedures, allowing for stronger conclusions regarding internal validity.

Depending on the *number of independent (IVs) and dependent variables (DVs)* considered, research designs may adopt different configurations. These include univariate-univariate (one IV and one DV), multivariate-univariate (multiple IVs and one DV), univariate–multivariate (one IV and multiple DVs), and multivariate–multivariate (multiple IVs and multiple DVs) structures (Creswell, 2009; Kerlinger, 1966).

According to the mode of participant organisation, designs may be classified as between-groups, within-groups, or mixed, depending on whether comparisons are conducted across distinct groups, within the same group, or through a combination of both strategies (Keppel, 1991). Designs may also be distinguished by the procedure used for group formation, including random assignment, block allocation, or matching techniques, depending on the study objectives and sample characteristics (Howell, 1992).

The *ecological context* in which data are collected constitutes another relevant cross-cutting classification criterion in Sport Sciences. Studies may be conducted in highly controlled environments such as laboratories, in partially controlled training contexts, or in naturalistic practice and competition settings. This distinction is critical, as context influences both the degree of variable control and the ecological validity and transferability of findings, considerations that are particularly salient in applied sport performance and intervention research (Gratton & Jones, 2014; Polit & Hungler, 2000).

Another relevant criterion concerns the *degree of researcher intervention* in the phenomenon under study. From this perspective, designs may be situated along a continuum ranging from non-interventionist approaches (Indu & Vidhukumar, 2020), based on observation and systematic recording without deliberate manipulation, to clearly interventionist designs, in which the researcher introduces planned changes to examine their effects (Ranganathan & Aggarwal, 2018). This distinction facilitates more precise differentiation between observational, experimental, and participatory studies, and is particularly useful in contextualising research conducted in authentic educational and sport settings, where balancing experimental control and ecological relevance is essential.

The *source of information* also represents a relevant classification criterion. Studies may rely on primary data collected specifically to address the research question, or on secondary data derived from existing records, databases, or documentary sources (Gratton & Jones, 2014). This distinction carries direct methodological implications in terms of control over the data collection process, data quality, and the inferential scope of the analyses conducted.

Research designs may further be classified according to the *unit of analysis* considered. Studies may focus on the individual, the group or team, or broader organisational levels such as clubs or sport systems (Salinero, 2004). The choice of unit of analysis influences not only the design structure but also the analytical strategies employed and the type of conclusions that can be drawn, particularly when data exhibit hierarchical or multilevel structures (Thomas et al., 2015).

Finally, the *degree of standardisation or flexibility* of the design constitutes a cross-cutting criterion that differentiates between closed designs, predefined with clearly specified procedures, and flexible or emergent designs that may evolve during the course of the study. This dimension is especially pertinent when distinguishing between quantitative, qualitative, and mixed-methods approaches, as the latter often combine structured phases with more adaptive components in response to interim findings and the evolving research process (Creswell, 2009).

The selection of a research design does not depend on an absolute hierarchy, but rather on the nature of the problem, the researcher's objectives, and the pursuit of validity. A principle of methodological complementarity applies, whereby a single phenomenon may be examined from different paradigmatic perspectives to address the research questions effectively.

Proposal for a Classification of Research Designs in Sport Sciences.

The classification of research designs is inherently contingent upon the conceptual criterion adopted; it is therefore essential to make explicit the logic underpinning the proposal advanced in this section (Ato et al., 2013; Cubo et al., 2011). In the absence of integrative models specifically tailored to the particularities of Sport Sciences, the present work advances an original classification of research designs conceived as a flexible and multidimensional framework. This framework is intended to accommodate diverse types of studies while recognising the coexistence of multiple design decisions within a single investigation.

The proposal is structured around an epistemological and methodological criterion grounded in the purpose of the knowledge generated and in the nature of the data employed (Polit & Hungler, 2000), This perspective allows a distinction to be drawn between studies that generate conceptual, instrumental, or procedural knowledge and those that produce empirical evidence through systematic observation of reality.

Based on this rationale, six broad categories of research designs are proposed: *methodological designs*, aimed at evaluating and optimising research procedures; theoretical designs, focused on the development and critical analysis of conceptual frameworks; *instrumental designs*, centred on the construction and validation of measurement tools; and *empirical designs*, which are further subdivided into *quantitative, qualitative, and mixed-methods designs* according to their analytical logic and the type of data employed.

Quantitative empirical designs focus on the analysis of numerical data to describe, relate, or explain sport-related phenomena and are typically structured around manipulative, associative, or descriptive strategies. Qualitative empirical designs, by contrast, seek to understand meanings, processes, and lived experiences within naturalistic contexts. Mixed-methods empirical designs aim to integrate quantitative and qualitative data to achieve a more comprehensive understanding of the phenomenon under study. This differentiation enables both approaches to be integrated within a common empirical framework while acknowledging their distinct epistemological and methodological foundations, thereby enhancing the coherence and conceptual clarity of the proposed classification (Creswell, 2009).

Figure 3 presents a general typology of research designs in Sport Sciences, organised into six major groups according to the nature of the knowledge generated and the methodological strategy adopted. This proposal should not be interpreted as a rigid or exclusionary taxonomy, but rather as an integrative conceptual framework that recognises the coexistence and complementarity of different design types within a single research project.

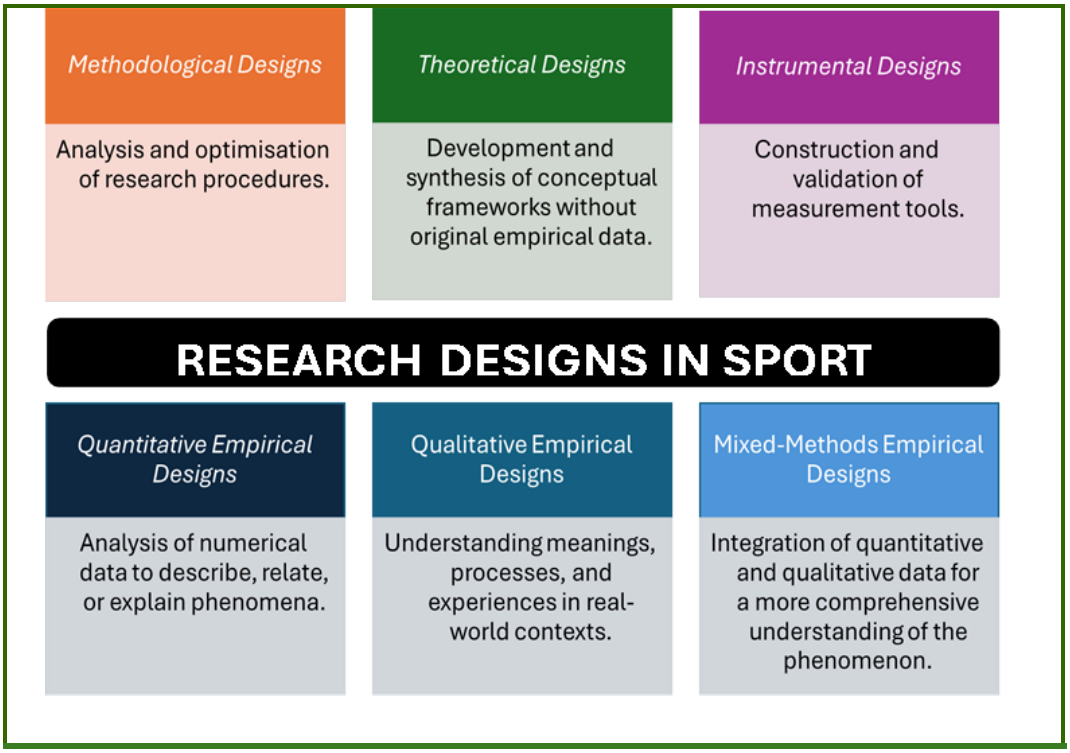

Figure 3. General typology of research designs in Sport Sciences.

This classification should not be understood merely as a taxonomic exercise, but as an operational methodological tool intended to guide researchers, reviewers, and editors in the accurate identification, selection, and reporting of research design. Sport Sciences are inherently applied fields of knowledge; consequently, the choice of research design is often conditioned by real-world practice settings. This frequently necessitates prioritising ecological validity and coherence of the research process over strict experimental control, without compromising scientific rigour (O'Donoghue, 2010).

Table 3 presents an integrative and open classification of research designs in Sport Sciences, organised according to a three-level hierarchical structure. At the macro level, the classification is structured around the nature of the knowledge generated (non-empirical vs. empirical). At the meso level, it differentiates the broad methodological strategies guiding the investigation. Finally, at the micro level, it specifies the concrete designs that operationalise these strategies. This proposal should not be interpreted as a closed taxonomy, but rather as a flexible conceptual framework in which different designs may coexist, combine, or overlap within a single study depending on its objectives and research context. Following the conceptual definition of each design, at least one illustrative reference from the Sport Sciences literature is provided to exemplify its practical application and to reinforce coherence between the theoretical framework and its effective use in empirical research.

It is important to emphasise that this classification should not be interpreted as a methodological checklist to be exhaustively fulfilled in every study, but rather as a conceptual map that organises and makes visible the diversity of possible design decisions in Sport Sciences. Its purpose is to facilitate the identification and communication of research design according to the most relevant criterion or criteria in relation to the research problem, rather than to impose a rigid or hierarchical categorisation. From this perspective, the table acknowledges that a single study may be simultaneously described across multiple dimensions, for example, as empirical quantitative, observational, longitudinal, and conducted in an ecological context, without implying methodological inconsistency. On the contrary, such multidimensional characterisation enhances precision and transparency in the description of the adopted design (Andrade, 2019). (Andrade, 2019).

Table 3. Research Designs in Sport Sciences

NON-EMPIRICAL RESEARCH DESIGNS IN SPORT SCIENCES

Nature of the Design	Methodological Strategy	Type of Design	Subtype / Modality
METHODOLOGICAL DESIGNS	Studies evaluating and comparing research methods		
	Methodological simulation studies		
	Studies on the development and optimisation of methodological procedures		
	Methodological studies on data analysis		
	Critical methodological reviews		
THEORETICAL DESIGNS	Chronological review		
	Narrative or thematic review		
	Systematic review		
	Quantitative systematic review or meta-analysis		
	Scoping review		
INSTRUMENTAL DESIGNS	Evaluation of psychometric properties		
	Validation of intervention protocols		
	Validation of technological devices		

EMPIRICAL RESEARCH DESIGNS IN SPORT SCIENCES

Naturaleza del diseño	Estrategia metodológica	Tipo de diseño	Subtipo / Modalidad	
QUANTITATIVE EMPIRICAL DESIGNS	Manipulative strategy designs	Experimental	*Simple experiments*	
			Factorial or complex experiments	
		Quasi-experimental	*Pre-experimental*	*Post-test only*
				Pre-test–post-test
			Quasi-experimental	*Cross-sectional*
				Longitudinal
		Single-case	*Basic*	*AB*
			Reversal	*ABAB*
			Non-reversal	
	Associative strategy designs	Comparative or correlational	*Retrospective (ex post facto)*	
			Cross-sectional	
			Prospective (longitudinal)	
			Developmental	
		Predictive		
		Explanatory		
	Descriptive strategy designs	Observational	*Quadrant I – Type I data*	*Idiographic Multidimensional Follow-Up Design*
				Idiographic Unidimensional Follow-Up Design
			Quadrant II – Type II data	*Idiographic Multidimensional Point Design*
				Idiographic Unidimensional Point Design
			Quadrant III – Type III data	*Nomothetic Multidimensional Point Design*
				Nomothetic Unidimensional Point Design
			Quadrant IV – Type VI data	*Nomothetic Multidimensional Follow-Up Design*
				Nomothetic Unidimensional Follow-Up Design
		Selective	*Descriptive*	*Probabilistic*
				Non-probabilistic
			Analytical	
QUALITATIVE EMPIRICAL DESIGNS	Case study	Single-case	*Exploratory*	
			Descriptive	
		Multiple-case	*Explanatory*	
	Ethnography			
	Grounded theory			
	Narrative designs			
	Phenomenology			
	Action research			
	Historical			
MIXED-METHODS EMPIRICAL DESIGNS	Convergent design			
	Explanatory sequential design			
	Exploratory sequential design			
	Embedded design			
	Transformative design			
	Multiphase design			

Note. The classification is not mutually exclusive; a single study may be simultaneously characterized from different design levels and methodological strategies.

Types of Methodological Designs in Sport Sciences

Methodological designs encompass studies whose primary objective is not to generate substantive empirical knowledge about a specific sport-related phenomenon, but rather to analyse, develop, compare, or refine the methodological procedures employed in scientific research. These designs operate at a meta-research level, as they critically examine how research is conducted, with the aim of optimising the quality, validity, reliability, and applicability of subsequent empirical studies (Ato et al., 2013). Methodological designs should therefore be understood as cross-cutting and complementary approaches, whose value lies in strengthening empirical research rather than in directly producing applied findings.

Within Sport Sciences, methodological designs are gaining increasing relevance due to the complexity of research contexts, the continual incorporation of measurement technologies, and the need to ensure coherence among research design, measurement procedures, and analytical strategies.

Studies Evaluating and Comparing Research Methods

Studies evaluating and comparing research methods aim to systematically examine the suitability, coherence, and implications of different methodological procedures applied to the same scientific problem. Their purpose is not to generate empirical knowledge about the phenomenon itself, but to assess how methodological decisions, related to data collection, processing, or analysis, affect the validity, reliability, and interpretation of findings (Mbuagbaw et al., 2020).

From an applied sport perspective, such designs have been used to compare measurement and analytical procedures for workload and performance variables in order to identify the most consistent and operational methods within real-world practice settings, thereby supporting more informed methodological decision-making (López-Sierra et al., 2025).

Methodological Simulation Studies

Methodological simulation studies are designed to evaluate the performance of analytical or statistical procedures under controlled and predefined conditions through the artificial generation of data. Their primary aim is to examine the robustness, sensitivity, and stability of specific methods in response to variations in sample size, data distribution, or variable structure.

Within Sport Sciences, this type of design has been employed to assess the effectiveness of analytical techniques and data-processing algorithms, particularly when access to large samples or repeated experimental trials is limited. For example, Amat et al. (2025) developed and validated an algorithmic system for the automatic detection of training phases in competitive canoeing. This approach enabled the evaluation of the method's stability and sensitivity under controlled scenarios, highlighting the value of methodological simulation as a validation tool in sport research.

Studies on the Development and Optimisation of Methodological Procedures

Studies on the development and optimisation of methodological procedures focus on proposing, refining, or systematising methods applicable to different phases of the research process, such as data collection protocols, observational categorisation criteria, or data quality control strategies. Their purpose is to enhance the coherence, applicability, and rigour of research procedures by evaluating and optimising methods, analytical approaches, or research practices in order to strengthen study design, implementation, and interpretation (Mbuagbaw et al., 2020).

In Sport Sciences, such designs have been instrumental in advancing systematic observational methodologies and in developing protocols tailored to real-world practice settings, where strict experimental control is often limited. These studies typically aim to optimise recording and analytical strategies through sensor-based systems and data quality control procedures, thereby contributing to improved validity and reliability in sport performance measurement (Rico-González et al., 2020).

Methodological Studies on Data Analysis

This type of methodological design critically examines the data analysis techniques employed in sport research, assessing the appropriateness of different statistical tests, multivariate models, or sequential and time-series analysis. Its primary objective is to determine how analytical decisions influence the interpretation of findings and to promote more rigorous and transparent use of statistical tools, consistent with the role of methodological research in evaluating the suitability and application of methods within empirical contexts (Morrissey & Hansen, 2014).

Hopkins et al. (2009) emphasise the importance of selecting appropriate statistical procedures, such as precision estimation rather than reliance on traditional null-hypothesis significance testing, the use of suitable data transformations, or regression modelling in validity studies, to enhance the coherence and practical utility of analyses in Sport Sciences. In a similar vein, (Fernández et al., 2024) examined the application of multivariate techniques, such as cluster analysis, and identified shortcomings in methodological transparency, underscoring the need for detailed reporting standards regarding algorithm criteria, determination of the number of clusters, and reproducibility of analyses.

Critical Methodological Reviews

Critical methodological reviews systematically and comparatively examine the procedures employed across a body of research, with the aim of identifying patterns, strengths, limitations, and trends in the application of scientific methods. This type of design enables the evaluation of the quality, consistency, and transparency of methodological strategies, thereby providing a foundation for improving research practices and strengthening the validity of findings (Smith & Bazis, 2021).

Within Sport Sciences, this approach has made it possible to identify shortcomings in the reporting of statistical techniques and analytical criteria. For instance, reviews addressing the use of principal component analysis (PCA) have highlighted the need for clear standards in reporting methodological procedures, component retention criteria, and practical applications in team sport studies. Such efforts contribute to enhanced transparency and comparability in multivariate performance analysis (Rojas-Valverde et al., 2020).

Types of Literature Review Designs in Sport Sciences

Literature reviews constitute fundamental research designs for organising, synthesising, and interpreting existing scientific knowledge within a given field. They enable the integration of findings, the identification of research gaps, and the detection of emerging trends, thereby providing a robust framework to support further empirical and theoretical advancement (Lipsey & Wilson, 2001). According to their purpose, level of systematisation, and analytical scope, five types of review designs can be distinguished within Sport Sciences.

Chronological Review

This type of review organises studies according to their temporal sequence, facilitating analysis of the historical development of the topic under investigation, the identification of conceptual or methodological shifts, and the understanding of how research lines have evolved over time. By situating findings within a chronological framework, it enables the recognition of phases of growth, stagnation, or renewal of knowledge and contextualises emerging phenomena within their scientific trajectory (Snyder, 2019).

From an applied sport perspective, several reviews have adopted this approach to map the evolution of specific fields. For example, chronological analyses have examined the development of elite sport and sport policy, highlighting institutional milestones and social transformations in the structure of collegiate sport (Park & Lim, 2015). Similarly, narrative research in Sport and Exercise Sciences since the early twenty-first century has been organised by decades to identify prevailing trends and methodological orientations within the field (Book et al., 2024).

Narrative or Thematic Review

A narrative or thematic review synthesises the literature by organising it around relevant categories, dimensions, or conceptual axes, thereby facilitating the identification of recurring patterns, theoretical convergences, and methodological divergences across studies. This approach provides an integrative overview of the state of knowledge, prioritising critical interpretation over exhaustive systematic coverage, and is particularly appropriate in interdisciplinary fields where the available evidence is heterogeneous (Aguilera, 2014)

Across sport-related scholarship, this design has been applied to explore complex phenomena such as the relationship between sport participation and women's empowerment (Streetman & Heinrich, 2024). It has also been used to analyse the application of mobile technologies for data collection in Sport and Health Sciences, synthesising evidence regarding their validity and reliability under field-based conditions (Peart et al., 2019).

Systematic Literature Review

A systematic review represents a methodologically rigorous, transparent, and replicable design aimed at identifying, critically appraising, and synthesising the available scientific evidence in relation to a clearly defined research question. This type of review is characterised by the use of explicit and predefined procedures for study identification, selection, quality assessment, and evidence synthesis, with the objective of minimising bias and ensuring the robustness and reproducibility of conclusions (Thomas et al., 2015).

Researchers in Sport Sciences have conducted systematic reviews using validated reporting and methodological protocols established in the literature, including PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Garcia-Santos et al., 2020); MOOSE (Meta-analysis of Observational Studies in Epidemiology) (Altmann et al., 2022); the Cochrane Handbook for Systematic Reviews of Interventions (Braakhuis et al., 2020); and ENTREQ (Enhancing Transparency in Reporting the Synthesis of Qualitative Research) (Wang et al., 2025).

Quantitative Systematic Review or Meta-Analysis

Meta-analysis is an advanced quantitative technique, typically embedded within the framework of a systematic review, that enables the statistical combination of results from multiple independent studies addressing the same research question. Its objective is to estimate pooled effects, calculate effect sizes, and assess between-study heterogeneity, thereby providing a numerical synthesis of the available evidence and enhancing the precision and inferential strength of conclusions (Borenstein et al., 2021).

Across sport performance and health research, meta-analytic approaches have been widely applied to quantify the impact of interventions on performance outcomes and physiological adaptations (Behm et al., 2016) and to examine processes related to talent identification (Kusdinar et al., 2021).

Scoping review

A scoping review aims to comprehensively map the existing body of scientific literature within a specific research domain, describing the nature, volume, and characteristics of the available evidence. This design is particularly suitable for emerging or underdeveloped fields, as it facilitates the identification of knowledge gaps, clarification of key concepts, and delineation of future research directions, without the requirement for the exhaustive methodological quality appraisal characteristic of systematic reviews (Ellmer et al., 2020).

This approach has proven especially valuable in structurally complex and heterogeneous domains, such as the examination of physical, physiological, and technical demands in adult male soccer according to playing position. By systematically mapping the literature and incorporating *evidence gap maps*, these reviews help identify underexplored areas, inform future research priorities, and strengthen the translation of evidence into applied practice (Sarmento et al., 2024).

Types of Instrumental Designs in Sport Sciences

In the field of Sports Science, instrumental designs can be organised into three broad categories according to the nature of the instrument under examination and the specific purpose of the validation process. This classification enables a more precise structuring of studies that share a common instrumental rationale but differ in procedural pathways, quality criteria, and the level of evidence required.

At their core, instrumental designs seek to ensure the validity, reliability, and practical utility of the tools employed in both research and professional practice. As such, they constitute an indispensable preliminary step for conducting rigorous empirical studies and for supporting robust knowledge transfer to real-world sport settings (Carretero-Dios & Pérez, 2007).

Instrumental Designs for the Validation of Psychometric Instruments

Instrumental designs focused on the validation of psychometric instruments are concerned with the development, cross-cultural adaptation, or validation of scales, questionnaires, and tests intended to measure psychological, pedagogical, or psychosocial constructs relevant to sport contexts, such as motivation, leadership, motivational climate, or decision-making. Their primary objective is to examine the psychometric properties of the instrument, including content validity, construct validity, and reliability, through appropriate statistical procedures (Carretero-Dios & Pérez, 2005).

In applied sport research, several questionnaires have been developed and validated to assess coaching orientations and related constructs through multi-phase instrument refinement processes. These procedures typically include exploratory and confirmatory factor analyses, internal consistency estimation, test-retest reliability assessment, and, where appropriate, factorial invariance testing to ensure that the instrument measures the intended theoretical construct accurately and consistently across groups (Feu et al., 2007; Feu et al., 2012). Similarly, Balaguer et al. (2007) validated the Spanish version of a sport-specific questionnaire using confirmatory factor analysis and reliability estimation procedures, thereby confirming the structural validity of the instrument within athletic populations.

Instrumental Designs for the Development and Validation of Intervention or Assessment Protocols

A second category of instrumental design focuses on the creation, systematisation, and validation of protocols applied to intervention, observation, or the assessment of performance and training processes. Unlike instrumental designs centred on the construction and validation of psychometric instruments, these studies prioritise the structure, sequencing, and practical applicability of the procedure itself, rather than the measurement of a latent construct (Ato et al., 2013; Montero & León, 2007). Such designs typically examine elements including internal coherence of the protocol, content validity, commonly established through expert judgement procedures (Escobar-Pérez & Cuervo-Martínez, 2008), operational clarity of the proposed phases or tasks, and the reliability associated with implementation in applied settings. The overarching objective is to ensure utility, reproducibility, and contextual appropriateness for professional practice (Carretero-Dios & Pérez, 2005; Haynes et al., 1995).

Standardising training programmes, validating educational interventions, developing structured observational protocols, and systematising physical fitness assessment procedures all illustrate the relevance of this design within Sport Sciences. Instrumental approaches have been employed, for example, to validate coach education programmes (González-Espinosa et al., 2017), game analysis observational protocols (Escudero-Tena et al., 2025), teacher training programmes (Cantonero-Cobos et al., 2025), physical evaluation procedures (Mancha-Triguero et al., 2019), physical test batteries (Gómez-Carmona et al., 2020), and task evaluation protocols (Feu et al., 2023), thereby reinforcing their replicability and applied value.

Instrumental Designs for the Validation of Measurement Devices and Technologies

A third category of instrumental design focuses on the validation of technological devices and measurement systems used to quantify physical, physiological, or biomechanical variables relevant to Sport Sciences, such as external load, internal load, or movement patterns. These studies systematically evaluate the accuracy, reliability, and criterion or concurrent validity of devices by comparing their outputs with reference standards or by examining measurement consistency under controlled and applied conditions. This methodological approach is essential for determining measurement error, limits of agreement, and the operational conditions under which generated data can be considered valid for research purposes and decision-making in sport settings (Gómez-Carmona et al., 2020), particularly when devices are deployed in real training and competition environments (Malone et al., 2017; McLaren et al., 2016).

Robust instrumental validation studies should: (a) explicitly report the device's technical specifications (sampling frequency, dynamic range, sensor type, and MEMS architecture); (b) detail the signal processing and filtering algorithms applied; (c) justify device placement and contextual conditions of use; and (d) quantify both systematic and random error under ecologically valid application scenarios. These recommendations are grounded in empirical evidence on the use of wearable inertial sensors in sport (Camomilla et al., 2018) , technical literature on microelectromechanical systems applied to performance analysis (Gómez-Carmona et al., 2021), and research conducted in physical education settings (Gómez-Carmona & Asín-Izquierdo, 2025).

In applied contexts, such designs are reflected in the validation of wearable inertial-based technologies for assessing kinematic and neuromuscular parameters across different sports (Marzano-Felisatti et al., 2025), as well as in the development and validation of intelligent applications designed to estimate biological maturation status in youth athletes (Shang et al., 2025). They also encompass studies examining the static and dynamic reliability of accelerometers according to anatomical placement (Gomez-Carmona et al., 2019), comparing the accuracy of GNSS systems with local positioning systems (LPS/UWB) (Bastida-Castillo, Gomez-Carmona, et al., 2019), and assessing the precision and inter-unit reliability of ultra-wideband tracking systems in indoor environments (Bastida-Castillo, Gómez-Carmona, et al., 2019).

Types of Quantitative Empirical Designs in Sport Sciences

Quantitative empirical designs in Sport Sciences encompass studies aimed at generating empirical evidence through the systematic collection of numerical data and their statistical analysis, in order to describe phenomena, examine relationships between variables, or test previously formulated hypotheses. These designs are grounded in a deductive logic and rely on standardised measurement procedures intended to ensure the validity, reliability, and generalisability of the findings. Quantitative empirical designs can be organised according to the methodological strategy adopted to address the phenomenon under investigation, distinguishing three broad and non-exclusive approaches: the *manipulative strategy*, focused on examining causal relationships through researcher intervention; the *associative strategy*, aimed at analysing covariation and functional relationships between variables without experimental manipulation; and the *descriptive strategy*, whose primary purpose is to systematically characterise the observed reality. This differentiation provides a coherent structure for organising the diversity of quantitative research conducted in Sport Sciences, taking into account the degree of control, the analytical purpose, and the inferential scope of each study.

Manipulative Strategy Designs

Manipulative strategy designs within quantitative empirical research are oriented toward examining causal relationships through the deliberate manipulation of one or more independent variables, while maintaining varying degrees of control over study conditions. Their primary objective is to estimate the effect of an intervention, treatment, or stimulus on dependent variables, allowing causal inferences with differing levels of internal validity depending on random allocation procedures, control of extraneous variables, and the application context. According to the classification

proposed by Montero and León (2007) y Ato et al. (2013), these designs include experimental, quasi-experimental, and single-case experimental designs, which are distinguished primarily by the degree of experimental control achieved.

In sport-related research, such designs are commonly employed to evaluate the effectiveness of interventions targeting performance enhancement or recovery, implemented through experimental, quasi-experimental, or single-case approaches in either controlled or ecologically valid settings. Within physical education and sport pedagogy, they have been used to examine the effects of training programmes, instructional interventions, or workload protocols on performance-related, physiological, biomechanical, or psychological variables. In school-based physical education contexts, these designs frequently assess the impact of teaching methodologies or intervention programmes on motor learning and psychoeducational outcomes, often through pre-post or between-group comparisons.

Experimental Designs

Experimental designs represent the methodological modality with the highest level of internal validity within manipulative strategies, as they rely on the deliberate manipulation of one or more independent variables, random allocation of participants, and systematic control of extraneous factors. These characteristics enable robust causal inferences regarding the effects of treatments or interventions. Structurally, such designs emerge from the interaction between treatment structure, control mechanisms, and error management, resulting in a wide range of simple or factorial experimental configurations adaptable to diverse research contexts (Ato et al., 2013).

Applications in physical education research have included the examination of pedagogical or contextual manipulations on motor performance and psychophysiological responses using factorial repeated-measures designs (Mulvenna et al., 2020). In sport performance research, experimental approaches have been employed to evaluate ergogenic interventions, environmental stimuli, or practice conditions affecting performance and decision-making through randomised controlled designs implemented in both simulated and competition-representative settings (Nieto-Acevedo et al., 2025).

From an operational standpoint, and considering treatment structure, control mechanisms, and the organisation of variance associated with participants or units of analysis, two broad types of experimental designs may be distinguished in Sport Sciences: *simple experiments* and *factorial or complex experiments*.

Simple experiments involve the manipulation of a single independent variable, allowing its specific effect on one or more dependent variables to be examined through between-group or within-group comparisons. Although grounded in core experimental principles, these designs may incorporate random allocation, repeated measures, or partial control strategies when contextual, ethical, or applied constraints preclude full experimental control. Their structural clarity facilitates straightforward interpretation of intervention effects, making them a frequent choice in applied sport research.

In performance settings, such designs have been used to assess the effect of a single manipulated factor through randomised controlled protocols incorporating within-subject comparisons between intervention and control conditions (Otte et al., 2021). Similarly, in physical education contexts, repeated-measures designs with a single experimental condition have been implemented to examine the impact of specific pedagogical manipulations on motor outcomes or psychophysiological responses.

Factorial or complex experiments involve the simultaneous manipulation of two or more independent variables, enabling the analysis of both main effects and potential interaction effects. This configuration enhances the explanatory capacity of the design and is particularly appropriate for addressing multifactorial phenomena, provided that rigorous control procedures, random allocation, and appropriate error variance management are maintained (Montero & León, 2007).

Educational research has applied factorial repeated-measures designs to investigate the combined influence of multiple variables on motor performance and psychophysiological responses under controlled experimental conditions (Mulvenna et al., 2020). In performance-oriented studies, factorial between-group designs have been used to examine

interactions between different stimuli or intervention conditions on performance, perceptual, or behavioural variables, allowing differential effects across experimental conditions to be systematically compared (Chen & Lin, 2020).

Quasi-Experimental Designs

Quasi-experimental designs, like true experimental designs, aim to examine causal relationships through the deliberate manipulation of an independent variable. However, they differ in the degree of experimental control achieved, typically due to the inability to randomly assign participants to study conditions or to fully control extraneous variables influencing the process (Campbell & Stanley, 2015; Rogers & Revész, 2019). These constraints primarily affect internal validity, although they do not undermine the utility of the design when appropriate methodological strategies for control and comparison are implemented (Shadish et al., 2002). Such designs are particularly suitable in applied contexts where organisational, ethical, or ecological constraints limit strict experimental control, as commonly occurs in educational interventions, training programmes, or studies conducted in authentic practice environments.

Based on the temporal structure of the intervention and the type of comparison established, manipulative strategy designs without random allocation may be classified into *pre-experimental* and *quasi-experimental* studies.

Pre-experimental designs are characterised by minimal control and include formats such as *post-only designs*, in which assessment occurs exclusively after the intervention, and *single-group pre-post designs*, where no comparison group is available and causal inference must therefore be interpreted with caution. In sport-related research, pre-experimental approaches have been used to evaluate training programmes or psychological interventions through temporal comparisons (Yalcin et al., 2025). In physical education settings, they have served to explore the initial impact of pedagogical methodologies on physical load or cognitive variables through single-group pre–post interventions (Calle et al., 2025; Pugliese et al., 2025).

Quasi-experimental designs may be further differentiated into *cross-sectional* and *longitudinal* formats according to the temporal structure of the intervention and data collection procedures. *Cross-sectional quasi-experimental* designs assess treatment effects at a single time point, typically through comparisons between non-equivalent groups or post-only structures. In sport performance contexts, such designs have been used to characterise variables in elite competition, for example acceleration profiles in professional players (Ibáñez, Gantois, et al., 2024), or workload variability in referees (Ibáñez, Vaquera, et al., 2024).

In contrast, *longitudinal quasi-experimental* designs incorporate repeated measurements over time, including pre–post formats with or without comparison groups and interrupted time-series designs. These configurations allow for relatively greater control and more robust interpretation of intervention effects despite the absence of random allocation. In sport performance research, longitudinal quasi-experimental approaches have been applied to examine variables across multiple competitive seasons, such as the identification of playing positions over time (Ibáñez et al., 2025).

Across both formats, these designs are typically implemented in naturalistic practice conditions, accepting partial experimental control in exchange for enhanced ecological validity and applied relevance. Within sport settings, quasi-experimental designs have been used to evaluate the effects of competition formats, preventive programmes, or technical–tactical interventions through comparisons between pre-existing groups or practice conditions (Birrento-Aguiar et al., 2025; Bleidelis et al., 2025; Rostami et al., 2025). Similarly, in physical education contexts, they are frequently employed with intact groups to examine the impact of active pedagogical methodologies on psychological and learning-related outcomes in university settings (Albaladejo-Saura et al., 2025).

Single-Case Experimental Designs

Single-case experimental designs are characterised by the systematic and repeated analysis of one or a small number of units, in which the participant or unit serves as their own control. These designs rely on the planned manipulation of the independent variable and the observation of corresponding changes in the dependent variable

across clearly delineated phases, such as baseline, intervention, and, where applicable, withdrawal or maintenance of the treatment (Barker et al., 2011). This phased structure enables the establishment of functional relationships between the intervention and the observed effects with a high degree of internal validity, provided that baseline stability is ensured and effects are replicated across phases (Freeman & Mash, 2015; Kazdin, 2019). Their application is particularly appropriate when sample sizes are small, interventions are highly individualised, or participant heterogeneity limits the feasibility of group-based designs, as is often the case in certain sport and educational contexts.

In sport and physical activity settings, these designs have been used to examine the effects of performance-oriented training programmes on functional and performance-related variables in populations with specific needs, through multiple-baseline designs incorporating longitudinal follow-up (Dutia et al., 2020). They have also been applied to evaluate psychological interventions aimed at enhancing exercise adherence and motivation, using staggered multiple-baseline structures and repeated measurements over time (Turner et al., 2025).

Single-case experimental designs may adopt different configurations depending on the number and sequence of phases (Ato et al., 2013). *Basic designs* (AB) consist of an initial baseline phase (A) followed by an intervention phase (B) and are commonly used in exploratory studies or when treatment withdrawal is not feasible. *Reversal designs* (e.g., ABAB or variants) introduce successive phases of intervention and withdrawal, allowing researchers to verify whether changes in the dependent variable systematically co-occur with the presence of the treatment. *Non-reversal designs*, such as multiple-baseline formats, apply the intervention in a staggered manner across different participants, behaviours, or settings and are particularly appropriate when withdrawal is impractical or ethically unjustifiable.

Although limited in terms of external generalisability, single-case experimental designs offer strong internal validity and substantial applied value when implemented rigorously and analysed in accordance with their temporal structure.

Associative Strategy Designs

Associative strategy designs within quantitative empirical research are intended to examine the functional relationships between two or more variables as they occur naturally, without deliberate manipulation by the researcher. Variables are observed and measured within their natural context, enabling the identification of patterns of association, covariation, or prediction according to the study objectives. Although the absence of experimental intervention precludes strict causal inference, these designs offer high ecological validity and are particularly well suited for investigating complex phenomena in authentic settings (Montero & León, 2007).

Depending on temporal logic, analytical direction, and study purpose, associative strategy designs may be structured into *comparative or correlational designs*, which aim to describe and quantify relationships between variables; *predictive designs*, focused on estimating one or more criterion variables from a set of predictors; and *explanatory designs*, intended to model more complex interrelations by integrating theoretical frameworks that advance understanding of the phenomena under investigation (Ato et al., 2013).

In sport research contexts, associative designs are commonly employed to examine relationships among educational variables, performance indicators, training load metrics, anthropometric characteristics, psychological factors, or contextual variables when experimental manipulation is either impractical or conceptually inappropriate.

Comparative or Correlational Designs

Comparative or correlational designs, also referred to as *ex post facto* designs, are intended to examine relationships between variables without deliberate manipulation of study conditions. Research is conducted using data collected in natural settings or derived from previously occurring situations in which participants are grouped according to pre-existing biological, psychological, sport-related, or contextual characteristics. Based on this classification, differences between groups or associations among variables are analysed in accordance with the study objectives.

Considering the temporal structure of data collection and the directionality of the analysis, these designs may be organised into four principal subtypes: *retrospective* or *ex post facto* studies, *cross-sectional* studies, *prospective* or *longitudinal* studies, and *developmental* studies.

Retrospective or ex post facto studies analyse relationships between variables based on events that have already occurred, without researcher intervention, and typically begin with the dependent variable to identify potential antecedent factors. This approach is particularly useful for examining prior exposure, practice history, or previous experiences linked to a given outcome, allowing the identification of associative patterns in real-world contexts.

In applied sport contexts, retrospective designs have been used to examine the relationship between training modalities and injury incidence by analysing exposure over defined time periods (Woodard et al., 2025) as well as to explore how prior injury history influences subsequent workload patterns and the risk of recurrent injury (Huang et al., 2025).

Cross-sectional studies assess all variables of interest simultaneously at a single time point without experimental manipulation. This configuration enables the description of group differences or associations as they naturally occur and is particularly suitable for profiling athletes, comparing subgroups, or exploring relationships among physiological, technical, tactical, or psychological variables related to performance.

Such designs have been employed to compare player profiles according to competitive level or playing position by analysing anthropometric and physical characteristics in high-performance contexts (Sebastia-Amat et al., 2020). They have also been used to examine gender differences in technical-tactical indicators and performance outcomes in professional competitions through observational and comparative analyses of match data recorded during a defined competitive period (Pozo-Ayerbe et al., 2024), as well as to analyse task structures in physical education and sport settings (Feu et al., 2022).

Prospective or longitudinal studies incorporate temporal follow-up of participants, recording one or more independent variables at an initial time point and examining their relationship with dependent variables measured subsequently. In these designs, potential predictors are assessed before the occurrence of the outcomes of interest, enabling the analysis of temporal associations and the estimation of predictive capacity without experimental intervention.

Across performance research, prospective approaches have been applied to investigate the association between workload indicators or physical condition metrics and competitive performance across a season, linking baseline physical measures with subsequent performance outcomes (Ibáñez et al., 2023; Jaspers et al., 2017). They have likewise been used to examine injury occurrence through longitudinal monitoring of athletes, assessing the relationship between accumulated workload metrics and the incidence of non-contact muscle injuries over the competitive cycle (Morgans et al., 2026).

Developmental studies focus on analysing change trajectories over time through repeated measurements in the same participants. These designs are particularly suited to investigating maturation processes, sport specialisation pathways, or performance progression during formative stages, as they enable the identification of developmental patterns, growth rates, and potentially non-linear trajectories associated with biological development and sustained practice.

Applied research adopting developmental designs has examined performance progression and talent development trajectories in youth athletes over multiple years. Through longitudinal repeated-measures analyses, these studies identify patterns of improvement, stability, or differential change across individuals, providing practical reference points for training planning and early talent identification (Romann et al., 2024).

Across all these subtypes, the absence of experimental manipulation necessitates cautious interpretation of findings in terms of association rather than causation, with particular emphasis on statistical control of potential confounding variables.

Predictive Designs

Predictive designs represent a specific subtype of associative designs in which the primary objective is to estimate the behaviour of a criterion variable from one or more predictor variables, measured without experimental manipulation. Unlike purely correlational studies, these designs establish an explicit functional distinction between predictors and outcomes, incorporating statistical models oriented toward prediction and, in some cases, classification of individuals or scenarios. However, this modelling approach does not imply strict causal relationships (Ato et al., 2013). Even when predictive performance is high, findings must be interpreted cautiously, as statistical prediction does not necessarily reflect an underlying causal mechanism (Montero & León, 2007).

Predictive designs applied in Sport Sciences have enabled the development of models aimed at anticipating events relevant to training planning and load management. In this context, they have been used to model the relationship between training load and subsequent injury risk through regression-based approaches grounded in accumulated internal and external load metrics (Gabbett, 2016). Similarly, predictive modelling has been applied to estimate future competitive performance from physical and fitness-related variables in team sports contexts (Malone et al., 2017). These approaches have also been employed to anticipate internal load responses and physiological adaptations to training, integrating indicators such as session rating of perceived exertion and heart rate into decision-support models for applied practice environments (Halson, 2014).

Explanatory Designs

Explanatory designs represent an advanced modality within associative research, aimed at analysing complex interrelationships among multiple variables through the integration of explicit theoretical models. Their purpose extends beyond describing associations or generating predictions; rather, they seek to elucidate the underlying mechanisms structuring those relationships by specifying hierarchical links among mediating, moderating, and criterion variables. To achieve this, researchers typically employ path analysis, structural equation modelling (SEM), and multilevel modelling, analytical approaches that enable the simultaneous estimation of multiple relationships and the evaluation of the theoretical model's goodness-of-fit to the empirical data (Ato et al., 2013).

In physical education research, explanatory designs have been used to test motivational frameworks grounded in self-determination theory, examining how perceived motivational climate relates to psychological need satisfaction and subsequent affective and behavioural outcomes through structural modelling approaches (Standage et al., 2005). Within sport performance contexts, similar designs have been applied to clarify how different forms of motivation are associated with enjoyment and sport commitment among youth football players (Garcia-Mas et al., 2010), as well as to investigate the influence of perceived motivational climate on team-level constructs such as cohesion and collective efficacy in elite squads, integrating longitudinal measurements and complex explanatory modelling (Heuzé et al., 2006).

Descriptive Strategy Designs

Descriptive strategy designs are intended to characterise and quantify phenomena, behaviours, or variables as they naturally occur in real-world contexts, without deliberate intervention by the researcher. Their primary purpose is to describe the distribution, frequency, profile, or temporal evolution of a phenomenon within a defined population, thereby providing an empirical foundation for understanding the object of study without attempting to establish causal relationships (Gratton & Jones, 2014; Thomas et al., 2015). Methodologically, these designs are characterised by limited experimental control, a strong emphasis on data quality and measurement accuracy, and particular attention to ecological validity, given that data are collected under conditions closely aligned with the authentic context under investigation (Ato et al., 2013; Salinero, 2004).

Within this strategy, two broad modalities may be distinguished. On the one hand, *observational designs* obtain information through systematic and structured observation of behaviours or events in natural practice settings. On the

other hand, *selective designs* rely on data collected from samples defined by personal, sport-related, or contextual characteristics, using instruments such as questionnaires, tests, standardised records, or pre-existing databases.

Observational Designs

Observational designs constitute a central modality within descriptive research in Sport Sciences and are grounded in the systematic recording of behaviour in natural or quasi-natural contexts, without deliberate manipulation of the variables under study (Manterola & Otzen, 2014). Their purpose is to describe and analyse actions, behaviours, or events as they emerge during authentic training and competition settings, thereby capturing the complexity of sport performance while preserving high levels of ecological validity (Anguera & Hernández-Mendo, 2013).

From an integrative methodological standpoint, observational designs fall within non-experimental empirical research and are structured through the combination of three fundamental criteria: (a) units of study (idiographic or nomothetic); (b) temporality of recording (point or follow-up); and (c) dimensionality of the observed behaviour (unidimensional or multidimensional) (Anguera et al., 2011; Ato et al., 2013; Sánchez-Algarra & Anguera, 2012). The articulation of these criteria enables precise specification of the design structure and guides both data collection procedures and subsequent analytical strategies.

The systematic interaction among these three axes is represented through a geometric model that facilitates classification of observational designs. Within this framework, units of study are arranged along the vertical axis, temporality along the horizontal axis, and dimensionality through concentric circles. This configuration generates four quadrants and eight distinct zones corresponding to the eight basic observational designs. The classification system is widely established in applied observational methodology in sport and serves as a methodological benchmark for the rigorous design of research in this domain (Anguera & Hernández-Mendo, 2013; Ato et al., 2013; Blanco-Villaseñor et al., 2014).

Quadrant I (Type I Data): Idiographic Unidimensional/Multidimensional Follow-Up Designs

Idiographic multidimensional follow-up designs focus on the intensive analysis of one or a small number of subjects or units of study, through the simultaneous recording of multiple behavioural dimensions and the systematic collection of data over time. This methodological configuration enables detailed examination of behavioural evolution, variability, and temporal dynamics in authentic practice contexts, capturing the complex and context-dependent nature of performance while maintaining high ecological validity.

Within educational sport settings, these designs have been employed in the development and validation of teaching-for-understanding approaches in net/wall sports, based on prolonged monitoring of students' motor and tactical behaviour (Castillo et al., 2026; Ruiz et al., 2026). Similarly, in youth sport contexts, they have supported the design and implementation of teaching-for-understanding proposals in invasion sports, through longitudinal analysis of multiple behavioural dimensions within structured educational interventions (García et al., 2025).

Quadrant II (Type II Data): Idiographic Unidimensional/Multidimensional Point Designs

Idiographic unidimensional point designs are intended for the intensive study of one or a small number of subjects or units of analysis through the recording of a single behavioural dimension at a specific time point. This methodological configuration is appropriate for describing discrete behaviours in clearly delimited situations, such as the presence, absence, or frequency of a specific action, without addressing temporal evolution or interaction with other behavioural dimensions.

In performance settings, these designs have been applied to point-in-time analyses of collective game actions in elite teams, based on the recording of a single behavioural dimension during specific matches or competitive scenarios. Their implementation has facilitated the description of discrete technical or tactical actions, while also enabling the evaluation

of the quality, reliability, and validity of observational systems used in authentic competitive contexts (Jiménez & Hernández-Mendo, 2016).

Quadrant III (Type III Data): Nomothetic Unidimensional/Multidimensional Point Designs

Nomothetic multidimensional point designs are characterised by the simultaneous analysis of multiple behavioural dimensions across a large number of subjects or units of analysis, recorded at a single time point. Methodologically, these designs enable the identification of collective patterns, behavioural regularities, and general trends within sport or educational populations, without addressing temporal evolution. They are particularly suitable for descriptive studies examining technical–tactical demands, performance behaviours, or motor interactions in natural training or competition settings.

In sport research, this design has been applied to analyse patterns of shot completion and game-ending actions in padel (Martín-Miguel et al., 2025), as well as technical–tactical behaviours associated with shooting performance in elite 3×3 basketball (Morillo-Baro (Morillo-Baro et al., 2025) et al., 2025). In physical education contexts, it has been used to investigate traditional sporting games, enabling point-in-time, multidimensional analysis of students' motor behaviours within structured educational environments (Lavega-Burgues et al., 2020).

Quadrant IV (Type IV Data): Nomothetic Unidimensional/Multidimensional Follow-Up Designs

Nomothetic multidimensional follow-up designs are defined by the simultaneous analysis of multiple behavioural dimensions across a large number of subjects or units of analysis, based on repeated observations over time. This methodological configuration enables the examination of evolving game patterns, collective dynamics, and tactical behaviours in authentic training or competition contexts, integrating behavioural complexity with its temporal dimension. Owing to their structural features, these designs represent one of the most comprehensive observational modalities within descriptive research in Sport Sciences.

In applied sport settings, this design has been used to analyse the evolution of shooting patterns in women's beach handball across an international tournament, employing longitudinal multidimensional recordings (Trejo-Silva et al., 2022). Similarly, in high-performance football, it has been applied to examine small-sided game situations over time in competitive contexts, based on systematic and repeated observation of official matches across multiple analytical dimensions (Amatria et al., 2025).

Selective Designs

Selective designs constitute a core modality within quantitative descriptive research and are based on the systematic collection of information through standardised instruments such as questionnaires, tests, or structured records administered to typically large samples. Their purpose is to describe characteristics, perceptions, opinions, or behaviours within a defined population or subpopulation, without manipulation of study variables and with minimal researcher intervention. Methodologically, they provide a broad and comparative overview of the phenomena under investigation and are particularly appropriate for population-based studies.

According to their analytical scope, selective designs may adopt a *descriptive approach*, focused on estimating population parameters such as frequencies, means, or distributions, or an *analytical approach*, incorporating comparisons across groups or categories while maintaining a non-causal objective. They may also be classified according to the sampling procedure employed, *probabilistic or non-probabilistic*, which directly influences sample representativeness and the extent to which findings can be generalised.

In Sport Sciences, selective designs have supported investigations with varying descriptive and analytical scopes depending on sampling strategy and research aims. *Descriptive selective studies using probabilistic sampling* have been conducted to estimate population-level parameters related to physical activity levels and participation habits among

school-aged children and adolescents (Telama et al., 2005). *Descriptive selective designs based on non-probabilistic sampling* have been employed to characterise sport, psychological, and workload profiles within accessible samples defined by contextual criteria or shared sport environments (Fernández-Cortes et al., 2022), to identify workload ranges during competition (Ibáñez et al., 2023), to analyse training tasks across different teams (Souza et al., 2025), or to describe motivational, emotional, and training load variables (Duque et al., 2022).

Finally, *analytical selective designs* have been used to compare groups defined by personal, educational, or sport-related variables while maintaining a non-causal purpose, as in studies examining motivational differences according to practice context or competitive level (Garcia-Mas et al., 2010). It should be noted that classifying studies as selective designs reflects methodological criteria, irrespective of the terminology originally used by authors in their respective methods sections.

Types of Qualitative Empirical Designs in Sport Sciences

Qualitative empirical designs encompass studies aimed at developing an in-depth understanding of complex phenomena related to experience, meaning, perception, and human interaction within sport contexts, without reliance on quantification or experimental manipulation of variables. These designs are grounded in interpretive and constructivist paradigms, seeking to explore how participants construct and attribute meaning to their experiences in specific training, educational, or competitive environments.

Methodologically, qualitative designs are characterised by procedural flexibility, the use of purposive or theoretical sampling strategies, data collection in naturalistic settings, and inductive analytical processes oriented toward the development of categories, interpretive patterns, or emergent conceptual framework (Creswell, 2009; Thomas et al., 2015). Within Sport Sciences, such approaches are particularly well suited to examining phenomena that are not readily reducible to numerical indicators, including decision-making processes, perceived exertion, the construction of athletic identity, group dynamics, and the subjective experience of training and competition (Smith & Sparkes, 2016).

Depending on the purpose of the study and the chosen inquiry strategy, qualitative empirical designs may be organised into *case study, ethnography, grounded theory, narrative designs, phenomenology, action research, and historical design*, each carrying distinct implications for data collection and analytical procedures (Smith & Sparkes, 2016; Varghese et al., 2025).

Case Study

The *case study* is a qualitative empirical design aimed at conducting an in-depth analysis of a bounded unit within its real-life context. The unit of analysis may correspond to an individual, a group, a team, an organisation, or a specific programme. Its purpose is to understand the functioning, characteristics, and distinctive features of the phenomenon under investigation from a holistic and context-sensitive perspective, prioritising rich, contextualised insight over statistical generalisation (Armour & MacDonald, 2012; Montero & León, 2007). This design relies on the use of multiple data sources, such as interviews, observations, documents, audiovisual materials, and technical reports, facilitating data triangulation and strengthening the credibility of the analysis.

Case studies are particularly suitable for examining singular, infrequent, or highly complex situations frequently encountered in Sport Sciences, including rehabilitation processes following severe injury (Liska et al., 2025), athlete career trajectories (Hong & Hong, 2024), team training dynamics (Sandbakk et al., 2025), innovative training programmes (Hemphill et al., 2019), or specific educational interventions in sport settings (Fan et al., 2025).

From a design perspective, case studies may adopt *single-case* or *multiple-case* formats. Multiple-case designs can incorporate cross-case comparison strategies to identify recurring patterns or salient contrasts across cases. In addition, case studies may serve *exploratory* purposes when the phenomenon is insufficiently understood; *descriptive* purposes

when the aim is to provide detailed characterisation of a particular situation; or *explanatory* purposes when the objective is to elucidate the mechanisms or processes underlying the phenomenon of interest.

Despite limitations in terms of population-level generalisability, case studies offer substantial heuristic and applied value, contributing meaningfully to the development of contextually grounded knowledge and to the transfer of findings into professional practice within Sport Sciences.

Ethnography

Ethnography is a qualitative design directed toward the systematic and prolonged study of groups or communities within their natural contexts, with the aim of understanding shared cultural patterns, norms, values, beliefs, and practices. This approach requires sustained immersion of the researcher in the field setting and typically relies on a combination of techniques such as participant observation, in-depth interviews, and document analysis (Smith & Sparkes, 2016; Thomas et al., 2015). From an epistemological standpoint, ethnography is grounded in interpretive paradigms, assuming the existence of multiple realities and privileging contextualised understanding over statistical generalisation (Creswell, 2009; Willig & Rogers, 2017).

In physical education research, ethnographic designs have been employed to examine educational and sociocultural processes through extended engagement in school settings, integrating participant observation, interviews, and analysis of curricular materials to explore how meanings are constructed and negotiated in everyday practice (Azzarito & Solmon, 2006; Barquero-Ruiz et al., 2024). Within sport contexts, ethnography has been used to investigate sport cultures and group dynamics through systematic observation of training sessions, competitions, and informal spaces, combined with analysis of the discourses of athletes, coaches, and other stakeholders (Merino-Orozco et al., 2020). Across both domains, this design foregrounds a process-oriented and contextually embedded interpretation grounded in the triangulation of data sources and methods, enabling a nuanced understanding of educational and sport-related phenomena from the participants' own perspectives (McKay, 2022).

Grounded Theory

Grounded theory is a qualitative design aimed at the inductive generation of explanatory theory concerning social processes, actions, or interactions, derived from systematically collected and analysed empirical data (e.g., interviews, observations, and documents), without reliance on predefined hypotheses or the testing of pre-existing theoretical frameworks (Armour & MacDonald, 2012; Bonilla-García & López-Suárez, 2016). The approach is distinguished by an iterative and cyclical process of data collection and analysis, grounded in progressive coding procedures, constant comparison across emerging categories, theoretical sampling, and the development of analytical memos. This process continues until conceptual saturation is achieved and the internally coherent explanatory model is fully articulated (Creswell, 2009; Smith & Sparkes, 2016).

Grounded theory has been employed to construct explanatory frameworks from progressively in Sports Science, generated qualitative data through systematic coding and ongoing comparison among emergent categories. Rather than beginning with a fixed theoretical lens, the design allows theoretical insights to emerge directly from participants' accounts and observed practices. It has been applied to examine formative, professional, and organisational processes in sport and educational contexts, with the aim of explaining competence development and decision-making from the participants' perspectives (García-Pinilla et al., 2023). In addition, grounded theory approaches have been used to explore meaning-making processes and cognitive discrepancies in both sport (Zhong et al., 2025) and educational settings (Sullivan, 2019), resulting in contextually grounded theoretical models that account for the configuration of beliefs, values, and action strategies.

Narrative Designs

Narrative designs focus on the study of participants' stories and personal accounts, seeking to understand how individuals construct meaning through their life and sport experiences (Armour & MacDonald, 2012). This approach places particular emphasis on the temporal and biographical dimensions of the phenomenon, organising events into coherent narrative sequences that allow for the reconstruction of trajectories, transitions, and processes of change. Methodologically, narrative inquiry facilitates the integration of both participant and researcher voices into an interpretive account, thereby enhancing analytical depth and contextual richness (Carless & Douglas, 2016; Creswell, 2009).

Narrative designs in sport research have been used to examine how individuals interpret and reinterpret the meaning of their sporting experiences over time through biographical analysis of personal stories (Papathomas & Lavallee, 2014). They have also informed research on injury, pain, sport retirement, and identity reconstruction by analysing sociocultural narratives across diverse sport settings (Everard et al., 2025). In addition, narrative approaches have contributed to making marginalised identities visible and challenging dominant discourses shaping participation and well-being in sport (McGannon & Smith, 2020), as well as to exploring cultural and migratory transitions in athletic careers through the reconstruction of athletes' sociocultural adaptation experiences (Prato et al., 2020).

Phenomenology

Phenomenology is a qualitative design aimed at describing and understanding the essence of a lived experience as perceived by those who have undergone it. Its objective is not to establish causal relationships or generate formal theory, but to identify the fundamental meanings underlying a phenomenon shared by several individuals. This approach demands a rigorous reflexive process on the part of the researcher, including explicit acknowledgment of prior assumptions and a systematic search for the essential structures of the experience under examination (Sharma, Jha, et al., 2023).

Within physical activity and sport research, phenomenology has been employed to access and interpret shared lived experiences by foregrounding the meanings participants attribute to their practice. Studies adopting this design have examined participation, inclusion, and personal development in adapted physical activity and sport contexts through in-depth interviews and hermeneutic analysis aimed at identifying common structures of meaning from social and community-oriented perspectives (González & Ibáñez, 2025). It has also informed investigations into the subjective experience of educational and professional formation in physical activity and health, exploring how students and practitioners perceive the integration of biopsychosocial approaches into their training and applied practice (Hinojosa-Torres et al., 2022). Furthermore, phenomenological inquiry has been used to understand the clinical experience of sport rehabilitation through semi-structured interviews and reflexive thematic analysis centred on the athlete's lived perspective (Kaye et al., 2022).

Action Research

Action research is an applied and transformative qualitative design that integrates knowledge generation with the improvement of professional practice through iterative cycles of planning, action, observation, and reflection. A defining feature of this approach is the close collaboration between researchers and participants, who assume active roles as agents of change and contribute not only to data analysis but also to the implementation of context-specific improvements (Armour & MacDonald, 2012; Smith & Sparkes, 2016). As noted by Montero and León (2007) and Sharma, Jha, et al. (2023), action research is distinguished by its strong ecological validity and its direct relevance for decision-making in authentic practice environments.

In high-performance sport settings, action research has been employed to enhance psychological support practices and professional development processes by engaging coaches, technical staff, and sport practitioners in structured reflective cycles aimed at fostering meaningful change (Gilbourne & Richardson, 2005). It has also informed the design,

implementation, and evaluation of educational interventions targeting athletes and coaches, addressing issues such as mental health, energy availability, and health communication through participatory co-design processes and formative evaluation strategies (Hook et al., 2025). In physical education contexts, action research has supported teacher professional development and pedagogical improvement, both in initial teacher education through guided reflective mentoring processes (Teixeira et al., 2025) and in in-service professional development programmes focused on inclusive education and critical reflection, promoting sustainable transformations in teaching practice (Kaloudis et al., 2025).

Historical Design

The historical design is a qualitative empirical approach devoted to the systematic analysis of past events and processes in order to understand their evolution and significance within specific social, cultural, and temporal contexts. It relies on the critical and interpretive use of primary and secondary documentary sources, prioritising rigorous reconstruction of events over the establishment of experimental causal relationships (Sharma, Jha, et al., 2023). The validity of historical inquiry depends on the authenticity, credibility, and contextualisation of sources, as well as on the researcher's capacity to interpret them in a situated manner, thereby avoiding anachronistic readings. Although it does not aim for statistical generalisation, its contribution lies in elucidating how historical processes have shaped contemporary practices, discourses, and institutional structures within Sport Sciences.

In sport-related scholarship, historical designs have been employed to interpret the development of sporting practices through documentary sources (Torrebadella-Flix, 2020, 2024), as well as visual and artistic materials, treating works of art as historical documents that both capture and construct the sporting reality of a given era within its contextual framework (Krueger, 2018). This approach has also informed analyses of the intersections among sport, politics, and gender across different historical periods (Schupbach, 2024). In physical education research, historical design has supported the examination of the origins and evolution of bodily practices through interpretive reconstruction grounded in documentary and visual archives (De Paula Machado Pasqua & De Toledo, 2025).

Types of Mixed-Methods Designs in Sport Sciences

Mixed-methods designs involve the planned and systematic integration of quantitative and qualitative approaches within a single study, with the aim of achieving a more comprehensive understanding of complex phenomena that cannot be fully captured through a single methodological lens. These designs are grounded in a pragmatic orientation, whereby the selection and combination of methods are driven by the nature of the research problem and the questions posed, prioritising the practical utility of the knowledge generated over strict adherence to a single epistemological stance.

Such approaches are particularly well suited to examining multifactorial phenomena in sport contexts, including performance processes, learning dynamics, training adherence, and the effectiveness of intervention programmes. Their added value lies in combining the descriptive and generalisable strengths of quantitative methods with the interpretive depth of qualitative inquiry, provided that both strands are explicitly integrated at one or more stages of the research process rather than merely conducted in parallel without meaningful interaction (Creswell, 2009; Sharma, Jha, et al., 2023).

Depending on the timing of data collection, the priority assigned to each methodological strand, and the purpose of integration, mixed-methods designs may be structured as *convergent designs, explanatory sequential designs, exploratory sequential designs, embedded designs, transformative designs, or multiphase designs*, each carrying distinct implications for study planning, analytical procedures, and interpretation of findings (Sharma, Jha, et al., 2023).

Convergent Design

A convergent design is characterised by the concurrent collection of quantitative and qualitative data, with both strands afforded equal priority within the study. Each dataset is analysed independently and subsequently integrated

through procedures such as comparison, triangulation, or systematic contrast, with the aim of identifying convergence, divergence, or complementarity in the findings (Adhikari & Timsina, 2024). According to Creswell (2009) , its principal strength lies in the capacity to provide a comprehensive understanding of the phenomenon within a bounded timeframe, provided that the integration process is rigorously planned from the outset of the study design.

This design is particularly suited to the parallel integration of objective indicators and subjective perceptions relating to the same phenomenon, enabling a holistic interpretation through structured triangulation of results. In athlete development research, it has been applied to jointly examine dual-career transition experiences alongside quantitative monitoring metrics (Linner et al., 2022). In performance contexts, convergent designs have been used to contrast objective analyses of coach behaviours with players' and staff members' perceptions of their impact on competitive performance (Zach et al., 2022). Within school physical education, this approach has enabled the integration of systematic motor behaviour observation with standardised testing to assess coordinative development following pedagogical interventions (Romeu et al., 2023). Likewise, in higher education settings, it has supported programme evaluation by combining quantitative measures of subjective well-being with qualitative data capturing students' emotional experiences (Retamal-Munoz et al., 2024).

Explanatory Sequential Design

An explanatory sequential design unfolds in two consecutive phases. It begins with the collection and analysis of quantitative data and is followed by a qualitative phase specifically intended to explain, elaborate on, or contextualise the results obtained in the initial stage. In this configuration, the quantitative strand is given priority and informs the design of the qualitative phase. Integration occurs when qualitative findings are explicitly used to interpret the numerical patterns identified in the first phase, often through integrated narratives or joint displays that combine both forms of evidence (Othman et al., 2020).

This design has been adopted in sport-related research to provide in-depth interpretation of quantitative outcomes linked to educational, health, performance, or behavioural variables. In higher education and psychosocial development contexts, it has been applied to examine the impact of educational interventions on constructs such as resilience among Sport Sciences students, combining pre-post measures with reflective diaries (Sánchez-Jiménez et al., 2025). In school physical education and teacher professional development, it has served to explore associations between teachers' participation in professional learning communities and collective efficacy, incorporating qualitative interviews to clarify patterns initially identified through questionnaires (Beddoes et al., 2025). Within performance sport and talent development research, this approach has enabled the interpretation of relationships among motivation, commitment, and selection processes through the integration of statistical analyses and retrospective interviews (Maciel et al., 2025). Similarly, in health and therapeutic exercise settings, explanatory sequential designs have been used to expand upon clinical survey findings by conducting interviews aimed at identifying organisational and professional factors influencing decision-making (Mansfield et al., 2025).

Exploratory Sequential Design

An *exploratory sequential design* follows a logic that is the reverse of the explanatory model. It begins with an exploratory qualitative phase aimed at identifying relevant categories, dimensions, or constructs, followed by a quantitative phase designed to operationalise, measure, and test these elements in larger samples (Munce et al., 2020). This structure ensures that quantitative instruments and models are grounded directly in participants' lived experiences and expressed meanings, thereby strengthening the conceptual validity of the measures developed (Creswell, 2009).

This design is particularly suitable when the objective is to build and subsequently validate complex models derived from initial empirical insight. In sport policy research, for example, it has been used to identify, through a qualitative phase, the key pillars associated with national sporting success, and then to develop a quantitative framework enabling

their measurement and cross-national comparison (De Bosscher et al., 2010). Similarly, in physical education and teacher education contexts, exploratory sequential designs have supported the reformulation of evaluation or intervention frameworks based on participants' experiences, integrating an initial qualitative exploration with the subsequent operationalisation and quantitative validation of newly identified dimensions (Hiew & Murray, 2024).

Embedded Design

An embedded design is a mixed-methods configuration in which one methodological strand assumes a dominant role, while the other is incorporated in a secondary capacity to support, contextualise, or enrich the findings of the primary approach. The supplementary strand may serve to triangulate results, provide complementary explanations, or characterise contextual features not fully captured by the dominant design; however, the core research questions are addressed principally through the leading methodological framework (Pereira, 2011). This structure is particularly appropriate when additional interpretive depth is sought without modifying the overarching logic of the study. Its rigorous implementation requires a clear specification of the function assigned to each methodological component, thereby preventing overlap that could generate ambiguity in the interpretation of results.

Within educational and sport research, embedded designs have been adopted when qualitative interviews are incorporated into quasi-experimental studies to contextualise quantitatively derived findings, as well as when quantitative measures are integrated into qualitative investigations to describe the setting or profile the participants (Decorte et al., 2024).

Transformative Design

A transformative design represents a mixed-methods approach in which quantitative and qualitative procedures are integrated within an explicit critical and axiological framework aimed at advancing social justice, equity, and inclusion. In this configuration, the selection and combination of methods are not conceived as methodologically neutral decisions; rather, they are guided by a critical, participatory, or emancipatory perspective that shapes all stages of the research process, with the explicit intention of challenging inequalities and fostering empowerment (Sharma, Jha, et al., 2023).

This design has been employed in sport-related research to examine and critically interrogate organisational structures, power relations, and governance practices, combining quantitative and qualitative evidence with a clearly transformative purpose (Freitas et al., 2017). In physical education contexts, a transformative orientation has been adopted to address issues of gender equity, social inclusion, and the promotion of health and well-being, positioning sport and physical activity as instruments for sustainable development and the reduction of inequalities (Ulset et al., 2025).

Multiphase Design

A multiphase design constitutes a complex form of mixed-methods research that organises a sequence of interrelated studies or phases in which quantitative and qualitative strategies are deliberately combined to generate progressive and cumulative knowledge about a shared research problem (Sharma, Bidari, et al., 2023). Each phase addresses specific objectives, yet all are aligned within an overarching framework, enabling a systematic progression from initial exploration to the development, validation, and implementation of applied models or interventions (Creswell, 2009). This configuration is particularly appropriate when research programmes are structured over time and require iterative refinement of instruments, models, or interventions across successive stages. Its added value lies in the coherence established between phases, ensuring that findings from earlier components inform the design and analytical decisions of subsequent ones, thereby strengthening both methodological integration and practical applicability.

In physical education and sport pedagogy, this design has been implemented in applied research programmes, the development of complex interventions, and large-scale longitudinal projects that link successive phases such as

theoretical reviews, observational studies, pilot testing, validation procedures, and intervention trials, integrating quantitative and qualitative variables through a structured and sequential logic (Scrabis-Fletcher & Silverman, 2010). Similarly, multiphase approaches have supported the co-design and implementation of hybrid pedagogical models, incorporating iterative cycles of data collection, reflection, and refinement to optimise both instructional coherence and learning outcomes (Evangelio et al., 2025). Complementing this line of work, the design has enabled progression from cross-sectional population-based studies to randomised pilot trials and intervention preference studies, thereby generating cumulative evidence to inform the progressive refinement of exercise programmes with therapeutic potentia (Churchill, 2025).

Conclusions

Research design constitutes a core element in the scientific process within Sport Sciences, functioning as the strategic framework that coherently articulates the theoretical rationale, data collection procedures, analytical decisions, and interpretation of findings. Its precise definition not only determines the internal and external validity of a study, but is also decisive for methodological transparency, reproducibility of results, and the critical appraisal of research by the scientific community. Accordingly, research design should not be regarded as a secondary formal requirement; rather, it represents a key epistemological and methodological component underpinning the quality of the knowledge generated and its subsequent dissemination through scientific publications.

Despite its structural relevance, a review of the literature reveals that in many published studies in Sport Sciences, research design is not explicitly and systematically reported, and is frequently conflated with methods, data collection techniques, or analytical procedures. In light of the findings of the present work, it is therefore recommended that a specific subsection explicitly devoted to research design be systematically incorporated within the methodology section of scientific articles. Figure 4 summarises this proposal, maintaining chromatic coherence with the hierarchical classification of decision levels previously presented (Figure 1), and illustrates how the differentiated reporting of design, method/procedure, and instruments clarifies the type of study conducted, the criteria used for its classification, and the strategic decisions adopted by the researcher. The systematic inclusion of such a subsection is proposed as a minimum structural standard to ensure conceptual clarity, methodological coherence, and replicability in Sport Sciences publications. This recommendation should not be interpreted merely as a structural suggestion, but as an operational criterion aimed at enhancing methodological quality across the field.

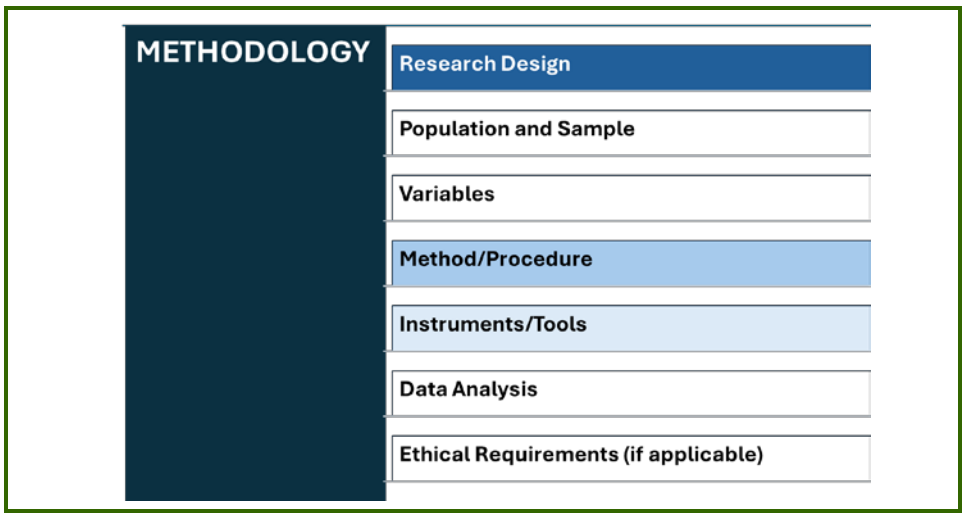

Figure 4. Proposal for the explicit hierarchical structuring of research design within the methodology section.

The proposed classification does not seek to replace or invalidate existing systems developed in other scientific domains; rather, it offers an original, flexible, integrative, and complementary framework specifically adapted to the epistemological, methodological, and applied particularities of Sport Sciences. Unlike many classifications commonly employed in the Social and Behavioural Sciences, which are typically based on a single classificatory criterion, the present proposal adopts a multidimensional perspective that allows the coexistence and integration of multiple criteria within a single study, depending on its objectives, context, and research strategy. Its principal contribution lies in providing a coherent structure capable of accommodating a wide range of designs, recognising that a single investigation may legitimately incorporate several classificatory dimensions without methodological inconsistency. In doing so, it promotes a more inclusive and systematic view of the research landscape in the field.

A further contribution of this work is the explicit recognition of the multidimensional nature of research design, understood not as a closed or mutually exclusive category, but as a constellation of interrelated decisions that may be described through different classificatory lenses. Consequently, researchers should clearly identify and declare the criterion or criteria used to characterise their design, whether methodological, temporal, contextual, or analytical. Such explicit reporting enhances internal coherence and facilitates more precise scientific communication, enabling reviewers and readers to interpret findings within an appropriate methodological framework.

This study contributes to the conceptual and methodological clarification of research design in Sport Sciences, promoting more rigorous and homogeneous reporting practices and offering a practical tool for both novice and experienced researchers in the planning, execution, and dissemination of high-quality scientific research. From this standpoint, it may serve as a methodological reference guide for the scientific community in the field, fostering greater coherence, rigour, and transparency in the identification and communication of research designs. The framework may also prove valuable for reviewers and journal editors engaged in methodological evaluation processes, as well as for postgraduate and doctoral training in Sport Sciences.

By way of illustration, and in alignment with the criteria summarised in Table 1, a study aimed at analysing differences in external load across playing positions over the course of a season could be classified at the macro level as empirical research; at the meso level as quantitative, given the use of numerical data and inferential statistical analyses; at the micro level as a prospective longitudinal comparative study; and at the technical level as a systematic observational method supported by previously validated inertial devices. This example demonstrates how the proposed framework enables the explicit identification, justification, and communication of methodological decisions.

Although the proposed classification provides a structured and coherent framework for delimiting research designs in Sport Sciences, it should be regarded as an open and evolving proposal. As it is grounded in a narrative review, it does not aim to be exhaustive, and the examples provided are illustrative rather than comprehensive. Future research could examine empirically the degree of its adoption and operational usefulness in scientific publications and editorial guidelines within the field, thereby contributing to its consolidation and potential refinement.

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References

Adhikari, R., & Timsina, T. P. (2024). An Educational Study Focused on the Application of Mixed Method Approach as a Research Method. *OCEM Journal of Management, Technology & Social Sciences*, *3*(1), 94-109. https://doi.org/10.3126/ocemjmtss.v3i1.62229

Aguilera, R. (2014). ¿Revisión sistemática, revisión narrativa o metaanálisis? *Revista de la Sociedad Española del Dolor*, *21*(6), 359-360.

Albaladejo-Saura, M., Mateo-Orcajada, A., Esparza-Ros, F., & Vaquero-Cristóbal, R. (2025). Effect of a “Team Based Learning” Methodology Intervention on the Psychological and Learning Variables of Sport Sciences University Students. *Education Sciences*, *15*(10). https://doi.org/10.3390/educsci15101405

Altmann, V. C., Mason, B. S., Geurts, T., van de Camp, S., & Vanlandewijck, Y. C. (2022). Objective Measurement of Ball-Handling Proficiency in Wheelchair Sports: A Systematic Review. *Frontiers in rehabilitation sciences*, *2*, Article 798675. https://doi.org/10.3389/fresc.2021.798675

Amat, S., Busquier, S., Gómez-Carmona, C. D., Gómez-López, M., & Pino-Ortega, J. (2025). Algorithm-Based Real-Time Analysis of Training Phases in Competitive Canoeing: An Automated Approach for Performance Monitoring. *Algorithms*, *18*(5). https://doi.org/10.3390/a18050242

Amatria, M., Elvira Aranda, C., & Pérez Turpin, J. A. (2025). Validación del NECoSsGOT. Un instrumento de observación para el análisis de las situaciones de juego reducido durante la competición en fútbol. *E-balonmano com Journal Sports Science*, *21*(1), 143-156. https://doi.org/10.17398/1885-7019.21.143

Andrade, C. (2019). Describing Research Design. *Indian Journal of Psychological Medicine*, *41*(2), 201-202. https://doi.org/10.4103/IJPSYM.IJPSYM_66_19

Anguera, M. T., Blanco, A., Hernández, A., & Losada, J. L. (2011). Diseños observacionales: ajuste y aplicación en psicología del deporte. *Cuadernos de Psicología del Deporte*, *11*(2).

Anguera, M. T., & Hernández-Mendo, A. (2013). Observational methodology in sport sciences. *E-balonmano com Journal Sports Science*, *9*(3), 135-160.

Armour, K. M., & MacDonald, D. (2012). *Research methods in physical education and youth sport* (Vol. 2). Routledge London.

Ato, M., Lopez, J. J., & Benavente, A. (2013). A classification system for research designs in psychology. *Anales de Psicología*, *29*(3), 1038-1059. https://doi.org/10.6018/analesps.29.3.178511

Azzarito, L., & Solmon, M. A. (2006). A feminist poststructuralist view on student bodies in physical education: Sites of compliance, resistance, and transformation [Article]. *Journal of Teaching in Physical Education*, *25*(2), 200-225. https://doi.org/10.1123/jtpe.25.2.200

Balaguer, I., Castillo, I., & Duda, J. L. (2007). Propiedades psicométricas de la Escala de Motivación Deportiva en deportistas españoles. *Revista Mexicana de Psicología*, *24*(2), 197-207.

Barker, J., McCarthy, P., Jones, M., & Moran, A. (2011). *Single-case research methods in sport and exercise psychology*. Routledge.

Barquero-Ruiz, C., Castro-Garcia, M., Moreno-Dona, A., & Kirk, D. (2024). Enacting a new curriculum: Chile's social uprising and the reshaping of physical education. *Sport Education and Society*. https://doi.org/10.1080/13573322.2024.2441987

Bastida-Castillo, A., Gómez-Carmona, C. D., De la Cruz-Sanchez, E., Reche-Royo, X., Ibáñez, S. J., & Pino-Ortega, J. (2019). Accuracy and Inter-Unit Reliability of Ultra-Wide-Band Tracking System in Indoor Exercise. *Applied Sciences-Basel*, *9*(5), Article 939. https://doi.org/10.3390/app9050939

Bastida-Castillo, A., Gomez-Carmona, C. D., De La Cruz Sanchez, E., & Pino-Ortega, J. (2019). Comparing accuracy between global positioning systems and ultra-wideband-based position tracking systems used for tactical analyses in soccer. *European Journal of Sport Science*, *19*(9), 1157-1165. https://doi.org/10.1080/17461391.2019.1584248

Beddoes, Z., Pennington, T., Phillips, A., Gerber, C., Weidenhamer, K., Morales, N., & Hendrix, S. (2025). Toward an Understanding of the Relationship Between Professional Learning Community Engagement and Collective Teacher Efficacy Among Physical Education Teachers. *Journal of Teaching in Physical Education*. https://doi.org/10.1123/jtpe.2024-0388

Behm, D. G., Blazevich, A. J., Kay, A. D., & McHugh, M. (2016). Acute effects of muscle stretching on physical performance, range of motion, and injury incidence in healthy active individuals: a systematic review. *Applied Physiology, Nutrition, and Metabolism*, *41*(1), 1-11. https://doi.org/10.1139/apnm-2015-0235

Birrento-Aguiar, R. A., Garcia-Angulo, F. J., Leonardo, L., Palao-Andres, J. M., & Ortega-Toro, E. (2025). Impact of Modified Competition Formats on Physical Performance in Under-14 Female Volleyball Players: The Role of Biological Maturity. *Sports (Basel)*, *13*(11). https://doi.org/10.3390/sports13110390

Blair, G., Cooper, J., Coppock, A., & Humphreys, M. (2019). Declaring and Diagnosing Research Designs. *American Political Science Review*, *113*(3), 838-859. https://doi.org/10.1017/s0003055419000194

Blanco-Villaseñor, Á., Castellano, J., Hernández Mendo, A., Sánchez-López, C. R., & Usabiaga, O. (2014). Aplicación de la TG en el deporte para el estudio de la fiabilidad, validez y estimación de la muestra. *Revista de Psicología del deporte*, *23*(1), 131-137.

Bleidelis, I., Luika, S., Kolesovs, A., & Boobani, B. (2025). A comparison of box-to-box and positional possession styles: selecting an appropriate game format for U13 footballers (a pilot study). *Frontiers in sports and active living*, *7*, 1634446. https://doi.org/10.3389/fspor.2025.1634446

Bonilla-García, M. Á., & López-Suárez, A. D. (2016). Ejemplificación del proceso metodológico de la teoría fundamentada. *Cinta de moebio*(57), 305-315. https://doi.org/10.4067/s0717-554x2016000300006

Book, R. T., Svensson, J., & Stambulova, N. (2024). Narrative research in sport and exercise science in the early 21st century: a state-of-the-art critical review. *Qualitative Research in Sport, Exercise and Health*, *16*(6), 567-597. https://doi.org/10.1080/2159676x.2024.2374827

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2021). *Introduction to meta-analysis*. John Wiley & Sons.

Braakhuis, A. J., Somerville, V. X., & Hurst, R. D. (2020). The effect of New Zealand blackcurrant on sport performance and related biomarkers: a systematic review and meta-analysis. *Journal of the International Society of Sports Nutrition*, *17*(1). https://doi.org/10.1186/s12970-020-00354-9

Calle, O., Antúnez, A., González-Espinosa, S., Ibáñez, S. J., & Feu, S. (2025). Monitoring the Impact of Two Pedagogical Models on Physical Load in an Alternative School Sport Using Inertial Devices. *Sensors (Basel)*, *25*(18). https://doi.org/10.3390/s25185929

Camerino, O., Castañer, M., & Anguera, T. M. (2014). *Mixed Methods Research in the Movement Sciences: Case studies in sport, physical education and dance (Vol. 5)*. Routledge.

Camomilla, V., Bergamini, E., Fantozzi, S., & Vannozzi, G. (2018). Trends Supporting the In-Field Use of Wearable Inertial Sensors for Sport Performance Evaluation: A Systematic Review. *Sensors (Basel)*, *18*(3). https://doi.org/10.3390/s18030873

Campbell, D. T., & Stanley, J. C. (2015). *Experimental and quasi-experimental designs for research*. Ravenio books.

Cantonero-Cobos, J. M., García-Ceberino, J. M., Conde-García, C., Sáenz-López Buñuel, P., & Fierro-Suero, S. (2025). Diseño, validación y evaluación del programa formativo para docentes: clima emocional y motivacional en el aula (CEYM). *E-balonmano com Journal Sports Science*, *21*(2), 229-240. https://doi.org/10.17398/1885-7019.21.229

Carless, D., & Douglas, K. (2016). Narrative research. *The Journal of Positive Psychology*, *12*(3), 307-308. https://doi.org/10.1080/17439760.2016.1262611

Carretero-Dios, H., & Pérez, C. (2005). Normas para el desarrollo y revisión de estudios instrumentales. *International Journal of Clinical and Health Psychology*, *5*(3), 521-551.

Carretero-Dios, H., & Pérez, C. (2007). Normas para el desarrollo y revisión de estudios instrumentales: consideraciones sobre la selección de tests en la investigación psicológica. *International Journal of Clinical and Health Psychology*, *7*(3), 863-882.

Castillo, L. A., Ruiz, J. M., & Castillo, A. N. (2026). Programa MET-IEF: Enseñanza comprensiva en deportes de campo separado. *Acciónmotriz*, *37*, 56-80.

Chen, C. Y., & Lin, Y. H. (2020). Persuasion effect of corporate social responsibility initiatives in professional sport franchise: Moderating effect analysis. *Plos One*, *15*(12), e0243579. https://doi.org/10.1371/journal.pone.0243579

Churchill, S. L. A. C. (2025). *Exploring the Role of Physical Activity and Exercise in Epilepsy Management* Iowa State University].

Creswell, J. W. (2009). *Research Design Qualitative, Quantitative, and Mixed Methods Approaches. 3rd edition*. SAGE.

Cubo, S., Martín, B., & Ramos, J. L. (2011). *Métodos de investigación y análisis de datos en ciencias sociales y de la salud*. Ediciones Pirámide.

De Bosscher, V., Shibli, S., van Bottenburg, M., De Knop, P., & Truyens, J. (2010). Developing a Method for Comparing the Elite Sport Systems and Policies of Nations: A Mixed Research Methods Approach [Article]. *Journal of Sport Management*, *24*(5), 567-600.

De Paula Machado Pasqua, L., & De Toledo, E. (2025). Historical Clues in N′golo for the Understanding of Floreio in Capoeira [Article]. *International Journal of the History of Sport*, *42*(10), 1065-1089. https://doi.org/10.1080/09523367.2025.2579123

Decorte, E., Jelen, N., & Nuytens, W. (2024). Developper la pratique dactivites physiques et sportives denfants de milieux defavorises: configurations et perspectives dune approche ascendante faite dinterventions en contexte scolaire. *Sante publique (Vandoeuvre-les-Nancy, France)*, *36*(HS2), 15-28. https://doi.org/10.3917/spub.hs2.2024.0015

Duque, V. H., Mancha-Triguero, D., Ibáñez, S. J., & Sáenz-López, P. (2022). Motivación, inteligencia emocional y carga de entrenamiento en función del género y categoría en baloncesto en edades escolares. *Cuadernos de Psicología del Deporte*, *22*(2), 15-32.

Dutia, I. M., Connick, M. J., Beckman, E. M., Johnston, L. M., Wilson, P. J., Macaro, A., & Tweedy, S. M. (2020). Evaluating the Effects of Performance-Focused Swimming Training on People with Cerebral Palsy Who Have High Support Needs – A Study Protocol Using Single-Case Experimental Design. *Brain Impairment*, *21*(2), 217-234. https://doi.org/10.1017/BrImp.2019.15

Ellmer, E., Rynne, S., & Enright, E. (2020). Learning in action sports: A scoping review. *European Physical Education Review*, *26*(1), 263-283. https://doi.org/10.1177/1356336x19851535

Escobar-Pérez, J., & Cuervo-Martínez, A. (2008). Validez de contenido y juicio de expertos: Una aproximación a su utilización. *Avances en medición*, *6*, 27–36.

Evangelio, C., González-Víllora, S., & Peiró-Velert, C. (2025). Health-Based Physical Education and Sport Education: the staging of a hybridization from a collaborative approach. *Sport, Education and Society*, *30*(5), 543-559.

Everard, C., Wadey, R., Day, M., & Howells, K. (2025). Examining the applied value of narratives for professional practice: An exploration of sports injury narratives in action [Article]. *Journal of Applied Sport Psychology*, *37*(1), 1-22. https://doi.org/10.1080/10413200.2024.2370793

Fan, X., Atkinson, O., & Bryan, R. R. (2025). An Ecological Perspective on Physical Education Teacher Education: Lessons Learned From Novice Teachers' Perceptions and Experiences. *Journal of Teaching in Physical Education*. https://doi.org/10.1123/jtpe.2024-0354

Fernández-Cortes, J. A., Cáceres, L., Antúnez, A., Gracía-Rubio, J., & Ibáñez, S. J. (2022). Análisis de la Influencia de las Variables Situacionales en el Fútbol Profesional. *Retos: nuevas tendencias en educación física, deporte y recreación*, *46*, 114-119.

Fernández, D., Casals, M., Oliver, M., Plensa, M., & Manisera, M. (2024). Reporting of clustering techniques in sports sciences: a scoping review. *Electronic Journal of Applied Statistical Analysis*, *17*(3), 653-675. https://doi.org/10.1285/i20705948v17n3p653

Ferraz, A., Duarte-Mendes, P., Sarmento, H., Valente-Dos-Santos, J., & Travassos, B. (2023). Tracking devices and physical performance analysis in team sports: a comprehensive framework for research-trends and future directions. *Frontiers in sports and active living*, *5*, 1284086. https://doi.org/10.3389/fspor.2023.1284086

Feu, S., Garcia-Rubio, J., Ibanez, S. J., & Antunez, A. (2022). External load of the tasks planned by teachers for learning handball. *Plos One*, *17*(4), e0265745-e0265745. https://doi.org/10.1371/journal.pone.0265745

Feu, S., Hernandez, J. d. l. C., Ibanez, S. J., & Antunez, A. (2023). Validation of the integral System of Task Analysis for Physical Education [Article]. *Profesorado. Revista de Curriculum y Formacion de Profesorado*, *27*(3), 21-43. https://doi.org/10.30827/profesorado.v27i3.21335

Feu, S., Ibáñez, S. J., Graça, A., & Sampaio, J. (2007). Psychometric evaluation of the Coach Orientation Questionnaire with a Spanish sample of handball coaches. *Psicothema*, *19*(4), 698-704.

Feu, S., Ibáñez, S. J., Lorenzo, A., Jiménez, S., & Cañadas, M. (2012). Professional knowledge acquired by handball coaches: training and experience. *Revista de Psicología del deporte*, *21*(1), 107-115.

Freeman, K. A., & Mash, E. J. (2015). Single-Case Research Designs. In *Handbook of clinical psychology* (pp. 322-350). JohnWiley & Sons, Inc.

Freitas, D., Girginov, V., & Teoldo, I. (2017). What do they do? Competency and managing in Brazilian Olympic Sport Federations. *European Sport Management Quarterly*, *17*(2), 193-209. https://doi.org/10.1080/16184742.2016.1244697

Gabbett, T. J. (2016). The training-injury prevention paradox: should athletes be training smarter and harder? *British journal of sports medicine*, *50*(5), 273-280. https://doi.org/10.1136/bjsports-2015-095788

Garcia-Mas, A., Palou, P., Gili, M., Ponseti, X., Borras, P. A., Vidal, J., Cruz, J., Torregrosa, M., Villamarin, F., & Sousa, C. (2010). Commitment, enjoyment and motivation in young soccer competitive players. *The Spanish Journal of Psychology*, *13*(2), 609-616. https://doi.org/10.1017/s1138741600002286

García-Pinilla, J. I., Pineda Miranda, B. A., Rodríguez-Jiménez, O. R., & Nicholls-Rodríguez, D. (2023). Desarrollo de competencias tecnológicas en docentes utilizando un modelo de diseño instruccional. *Educación y Educadores*, *26*(1), 1-19. https://doi.org/10.5294/edu.2023.26.1.3

Garcia-Santos, D., Gómez-Ruano, M. A., Vaquera, A., & Ibáñez, S. J. (2020). Systematic review of basketball referees' performances. *International Journal of Performance Analysis in Sport*, *20*(3), 495-533. https://doi.org/10.1080/24748668.2020.1758437

García, A. C., Ruiz, J. M., & Castillo, L. A. (2025). Aplicación de un método de enseñanza comprensiva para deportes de participación alternada en edad escolar. *Acciónmotriz*, *36*, 62-81.

Gilbourne, D., & Richardson, D. (2005). A practitioner-focused approach to the provision of psychological support in soccer: Adopting action research themes and processes [Article; Proceedings Paper]. *Journal of sports sciences*, *23*(6), 651-658. https://doi.org/10.1080/02640410400021344

Gómez-Carmona, C. D., & Asín-Izquierdo, I. (2025). Positioning Technology and Microelectromechanical Systems in Early Childhood Education and Care. In *Physical Education in Early Childhood. Movement and Development from 3 to 6 Years* (pp. 523-538). Routledge, Taylor & Francis Group.

Gomez-Carmona, C. D., Bastida-Castillo, A., Garcia-Rubio, J., Ibanez, S. J., & Pino-Ortega, J. (2019). Static and dynamic reliability of WIMU PRO (TM) accelerometers according to anatomical placement. *Proceedings of the Institution of Mechanical Engineers Part P-Journal of Sports Engineering and Technology*, *233*(2), 238-248. https://doi.org/10.1177/1754337118816922

Gómez-Carmona, C. D., Bastida-Castillo, A., Ibáñez, S. J., & Pino-Ortega, J. (2020). Accelerometry as a method for external workload monitoring in invasion team sports. A systematic review. *Plos One*, *15*(8), e0236643. https://doi.org/https://doi.org/10.1371/journal.pone.0236643

Gómez-Carmona, C. D., Pino-Ortega, J., & Ibáñez, S. J. (2020). Design and validity of a field test battery for assessing multi-location external load profile in invasion team sports. *E-Balonmano Com*, *16*(1), 23-48. <Go to ISI>://WOS:000513765700003

Gómez-Carmona, C. D., Pino-Ortega, J., & Rico-González, M. (2021). Microelectromechanical systems. In *The Use of Applied Technology in Team Sport* (pp. 52-73). Routledge.

González-Espinosa, S., Ibáñez, S. J., & Feu, S. (2017). Design of two basketball teaching programs in two different teaching methods. *E-balonmano com Journal Sports Science*, *13*(2), 131-152.

González, E. A. R., & Ibáñez, D. T. V. (2025). Challenges of physical activity and adapted sports for the overall development of people with disabilities. *Educacion Fisica Y Ciencia*, *27*(1), Article e324. https://doi.org/10.24215/23142561e324

Graham, C. A., Simon, E. L., & Knott, J. (2020). Study design: A research primer for low- and middle-income countries. *African Journal of Emergency Medicine*, *10*(Suppl 2), S115-S119. https://doi.org/10.1016/j.afjem.2020.10.007

Gratton, C., & Jones, I. (2014). *Research methods for sports studies.* Routledge.

Hakim, C. (2000). *Research design: successful designs for social and economic research*. Routledge.

Halson, S. L. (2014). Monitoring training load to understand fatigue in athletes. *Sports Medicine*, *44 Suppl 2*(Suppl 2), S139-147. https://doi.org/10.1007/s40279-014-0253-z

Haynes, S., Richard, D., & Kubany, E. (1995). Content Validity in Psychological Assessment: A Functional Approach to Concepts and Methods. *Psychological Assessment*, *7*(3), 238-247.

Hemphill, M. A., Gordon, B., & Wright, P. M. (2019). Sports as a passport to success: life skill integration in a positive youth development program [Article]. *Physical Education and Sport Pedagogy*, *24*(4), 390-401. https://doi.org/10.1080/17408989.2019.1606901

Hernández, R., Fernández, C., & Batista, P. (2014). *Metodologia de la Investigación (6ª Edición)*. Mc Graw Hill Education.

Heuzé, J.-P., Sarrazin, P., Masiero, M., Raimbault, N., & Thomas, J.-P. (2006). The Relationships of Perceived Motivational Climate to Cohesion and Collective Efficacy in Elite Female Teams. *Journal of Applied Sport Psychology*, *18*(3), 201-218. https://doi.org/10.1080/10413200600830273

Hiew, W., & Murray, J. (2024). Enhancing Huber's evaluation framework for teacher professional development programme [Article]. *Professional Development in Education*, *50*(4), 669-683. https://doi.org/10.1080/19415257.2021.1901236

Hinojosa-Torres, C., Espoz-Lazo, S., Soto-Garcia, D., Zavala-Crichton, J. P., & Farias-Valenzuela, C. (2022). The Competition on the Handball Initiation: Analysis of the Pedagogical Approach in Latin America. *Sport Tk-Revista Euroamericana De Ciencias Del Deporte*, *11*.

Hong, H. J., & Hong, S. H. (2024). Dual career (DC) experiences of Korean elite judokas before and at university. *Psychology of Sport and Exercise*, *70*, Article 102564. https://doi.org/10.1016/j.psychsport.2023.102564

Hook, M., Knight, C. J., & McGawley, K. (2025). Stigmatised health topics in sport: An action research approach to enhance knowledge and communication. *Journal of sports sciences*, Article Pmid 8405364. https://doi.org/10.1080/02640414.2025.2598171

Hopkins, W. G., Marshall, S. W., Batterham, A. M., & Hanin, J. (2009). Progressive Statistics for Studies in Sports Medicine and Exercise Science [Article]. *Medicine & Science in Sports & Exercise*, *41*(1), 3-12. https://doi.org/10.1249/MSS.0b013e31818cb278

Howell, D. C. (1992). *Statistical methods for psychology*. PWS-Kent Publishing Co.

Huang, Y., Wang, S., Li, C., Wang, Y., Bai, Z., Lv, B., Gui, Y., & Wei, Z. (2025). Investigating the effects of previous injury on subsequent training loads, physical fitness, and injuries in youth female basketball players. *Frontiers in Physiology*, *16*, 1506611. https://doi.org/10.3389/fphys.2025.1506611

Ibáñez, S. J., Courel-Ibáñez, J., Contreras-García, J. M., & Piñar-López, M. I. (2025). Redefining player roles in professional women's basketball: From traditional positions to functional profiles. *Plos One*, *20*(9), e0330726. https://doi.org/10.1371/journal.pone.0330726

Ibáñez, S. J., Gantois, P., Rico-González, M., García-Rubio, J., & Ortega, J. P. (2024). Profile of Accelerations and Decelerations in Young Basketball Players. *Applied Sciences*, *14*(10). https://doi.org/10.3390/app14104120

Ibáñez, S. J., López-Sierra, P., Lorenzo, A., & Feu, S. (2023). Kinematic and Neuromuscular Ranges of External Loading in Professional Basketball Players during Competition. *Applied Sciences*, *13*(21). https://doi.org/10.3390/app132111936

Ibáñez, S. J., Piñar, M. I., García, D., & Mancha-Triguero, D. (2023). Physical Fitness as a Predictor of Performance during Competition in Professional Women's Basketball Players. *International Journal of Environmental Research and Public Health*, *20*(2). https://doi.org/10.3390/ijerph20020988

Ibáñez, S. J., Vaquera, A., Mancha-Triguero, D., & Escudero-Tena, A. (2024). Variability in the Load of Professional Basketball Referees during Competition. *Applied Sciences*, *14*(3). https://doi.org/10.3390/app14031177

Indu, P. V., & Vidhukumar, K. (2020). Research designs-an overview. *Kerala Journal of Psychiatry*, *32*(1). https://doi.org/10.30834/kjp.32.1.2019.179

Jaspers, A., Brink, M. S., Probst, S. G., Frencken, W. G., & Helsen, W. F. (2017). Relationships Between Training Load Indicators and Training Outcomes in Professional Soccer. *Sports Medicine*, *47*(3), 533-544. https://doi.org/10.1007/s40279-016-0591-0

Jiménez, J., & Hernández-Mendo, A. (2016). Análisis de la calidad del dato y generalizabilidad de un sistema de observación del contraataque en el balonmano de élite. *E-balonmano com Journal Sports Science*, *12*(1), 31-44.

Kaloudis, T., Georgiadis, K., Travlos, A. K., & Theodorakis, Y. (2025). Fostering Reflective Thinking in Physical Education Teachers: An Action Research Study Promoting Paralympic Values and Inclusive Practices. *Education Sciences*, *15*(7), Article 823. https://doi.org/10.3390/educsci15070823

Kaye, J. A., Spence, D., & Alexanders, J. (2022). Using a biopsychosocial approach within acl rehabilitation: an exploration of student physiotherapists` perceptions and experiences. *Physiotherapy Theory and Practice*, *38*(11), 1718-1730. https://doi.org/10.1080/09593985.2021.1882019

Kazdin, A. E. (2019). Single-case experimental designs. Evaluating interventions in research and clinical practice. *Behaviour Research and Therapy*, *117*, 3-17. https://doi.org/10.1016/j.brat.2018.11.015

Keppel, G. (1991). *Design and analysis: A researcher's handbook*. Prentice-Hall, Inc.

Kerlinger, F. N. (1966). *Foundations of behavioral research*. Holt, Rinehart and Winston.

Krueger, M. (2018). German Sport History as Reflected in 'Sporting Art'. *International Journal of the History of Sport*, *35*(17-18), 1748-1776. https://doi.org/10.1080/09523367.2019.1586671

Kusdinar, Y., Abdullah, A. G., Ma'Mun, A., & Rusdiana, A. (2021). Revisiting sports talent identification: a meta analysis. *Journal of Engineering Science and Technology*, *16*(2), 1272-1286.

Lavega-Burgues, P., Luchoro-Parrilla, R. A., Serna, J., Salas-Santandreu, C., Aires-Araujo, P., Rodriguez-Arregi, R., Munoz-Arroyave, V., Ensenyat, A., Damian-Silva, S., Machado, L., Prat, Q., Saez de Ocariz, U., Rillo-Albert, A., Martin-Martinez, D., & Pic, M. (2020). Enhancing Multimodal Learning Through Traditional Sporting Games: Marro360 degrees. *Frontiers in Psychology*, *11*, 1384. https://doi.org/10.3389/fpsyg.2020.01384

Linner, L., Stambulova, N., & Henriksen, K. (2022). Facilitating Student-Athletes' Dual Career Transition: A Scandinavian University Case Study [Article]. *Sport Exercise and Performance Psychology*, *11*(2), 107-123. https://doi.org/10.1037/spy0000275

Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. SAGE publications, Inc.

Liska, T. M., Flaro, H., Stever, M., Caron, J. G., Duncan, L. R., & Sweet, S. N. (2025). Exploring Physical Activity Maintenance Among Adults With Spinal Cord Injury: A Multiple Case Study. *Journal of Sport & Exercise Psychology*. https://doi.org/10.1123/jsep.2025-0087

López-Sierra, P., Gómez-Ruano, M. A., Feu, S., & Ibáñez, S. J. (2025). A comprehensive analysis of internal and external load monitoring systems in basketball. *Scientific Reports*, *15*(1), 41851. https://doi.org/10.1038/s41598-025-25768-w

Maciel, L. F. P., Beirith, M. K., Ibáñez, S. J., & Folle, A. (2025). Involvement in physical and sports activities: what characteristics lead athletes to be selected for basketball teams in Brazil? *E-balonmano com Journal Sports Science*, *21*(3, special issue), 435-446. https://doi.org/10.17398/1885-7019.21.435

Malone, J. J., Lovell, R., Varley, M. C., & Coutts, A. J. (2017). Unpacking the Black Box: Applications and Considerations for Using GPS Devices in Sport. *International Journal of Sports Physiology and Performance*, *12*, 18-26. https://doi.org/10.1123/ijspp.2016-0236

Malone, S., Owen, A., Newton, M., Mendes, B., Collins, K. D., & Gabbett, T. J. (2017). The acute:chonic workload ratio in relation to injury risk in professional soccer. *Journal of Science and Medicine in Sport*, *20*(6), 561-565. https://doi.org/10.1016/j.jsams.2016.10.014

Mancha-Triguero, D., García-Rubio, J., & Ibáñez, S. J. (2019). SBAFIT: a field-based test battery to assess physical fitness in basketball players. *E-balonmano com Journal Sports Science*, *15*(2), 107-126.

Mansfield, M., Jong, S. T., & Smith, T. (2025). "You do it to cover your own back": The assessment of cervical spine radiculopathy among physiotherapists in the United Kingdom: A mixed methods research study. *Plos One*, *20*(7), Article e0325922. https://doi.org/10.1371/journal.pone.0325922

Manterola, C., & Otzen, T. (2014). Estudios observacionales: los diseños utilizados con mayor frecuencia en investigación clínica. *International Journal of Morphology*, *32*(2), 634-645.

Martín-Miguel, I., Sánchez-Alcaraz, B. J., Escudero-Tena, A., Conde-Ripoll, R., & Muñoz, D. (2025). Diferencias en la finalización del punto de oro en pádel profesional masculino y femenino. *E-balonmano com Journal Sports Science*, *21*(1), 27-36. https://doi.org/10.17398/1885-7019.21.27

Marzano-Felisatti, J. M., Pino-Ortega, J., Garcia-de-Alcaraz, A., Portillo, J., Guzman-Lujan, J. F., & Priego-Quesada, J. I. (2025). Validation of the WIMU PROTM Device for Jump Detection in Beach Volleyball: A Gender-Based Analysis during Official Competitions [Article]. *Journal of human kinetics*, *98*, 183-193. https://doi.org/10.5114/jhk/196549

Mbuagbaw, L., Lawson, D. O., Puljak, L., Allison, D. B., & Thabane, L. (2020). A tutorial on methodological studies: the what, when, how and why. *BMC Medical Research Methodology*, *20*(1), 226. https://doi.org/10.1186/s12874-020-01107-7

McGannon, K. R., & Smith, B. (2020). Expanding socio-cultural identity research in sport psycho-logy: The potential of athlete autobiographies. *Quaderns de Psicologia*, *22*(3). https://doi.org/10.5565/rev/qpsicologia.1556

McKay, C. (2022). Embodiment, identity and disability sport: an ethnography of elite visually impaired athletes. *Sport Education and Society*, *27*(2), 224-227. https://doi.org/10.1080/13573322.2021.2010851

McLaren, S. J., Graham, M., Spears, I. R., & Weston, M. (2016). The Sensitivity of Differential Ratings of Perceived Exertion as Measures of Internal Load. *International Journal of Sports Physiology and Performance*, *11*(3), 404-406. https://doi.org/10.1123/ijspp.2015-0223

Merino-Orozco, A., Berbegal-Vazquez, A., Arraiz-Perez, A., & Sabiron-Sierra, F. (2020). Sports monoculture and vehicular jargon in the educational value of school football in Spain. *Culture Education*, *32*(3), 583-608. https://doi.org/10.1080/11356405.2020.1785157

Montero, I., & León, O. G. (2007). A guide for naming research studies in Psychology. *International Journal of Clinical and Health Psychology*, *7*(3), 847-862.

Morgans, R., Oliveira, R., Mandorino, M., Zmijewski, P., Ryan, B., Modric, T., Teixeira, J., & Moreira, A. (2026). The loading impact of training and match-play on non-contact muscle injuries in elite male soccer players. A seasonal analysis. *Biology of Sport*. https://doi.org/10.5114/biolsport.2026.153305

Morillo-Baro, J. P., Rivera-Gálvez, A., Quiñones-Rodríguez, Y., Caballero-Cerbán, M., Hernández-Mendo, A., & Reigal, R. E. (2025). Análisis de las conductas de los lanzamientos triples en Baloncesto 3x3. *E-balonmano com Journal Sports Science*, *21*(3), 471-484. https://doi.org/10.17398/1885-7019.21.471

Morrissey, M. B., & Hansen, T. (2014). In search of the best methods for multivariate selection analysis. *Methods in Ecology and Evolution*, *5*(10), 1095-1109. https://doi.org/10.1111/2041-210x.12259

Mozolev, O., & Polishchuk, O. (2024). The essence and content of scientific research methodology. *Journal of Education, Health and Sport*, *63*, 279-288. https://doi.org/10.12775/jehs.2024.63.020

Mulvenna, M., Adie, J. W., Sage, L. D., Wilson, N. E., & Howat, D. (2020). Approach-achievement goals and motivational context on psycho-physiological functioning and performance among novice basketball players. *Psychology of Sport and Exercise*, *51*. https://doi.org/10.1016/j.psychsport.2020.101714

Munce, S., Guetterman, T., & Jaglal, S. (2020). Using the Exploratory Sequential Design for Complex Intervention Development: Example of the Development of a Self-Management Program for Spinal Cord Injury. *Journal of Mixed Methods Research*(15), 37-60. https://doi.org/https://doi.org/10.1177/1558689820901936

Nelson, L., Groom, R., & Potrac, P. (2014). *Research methods in sports coaching*. Routledge

Nieto-Acevedo, R., Garcia-Sanchez, C., Bravo-Sanchez, A., Abian-Vicen, J., Abian, P., Portillo, J., Martinez-Rubio, C., Lorenzo Calvo, J., & Diaz-Lara, J. (2025). Impact of Caffeine Intake on Female Basketball Players' Performance. *Nutrients*, *17*(2). https://doi.org/10.3390/nu17020235

O'Donoghue, P. (2010). *Research methods for sports performance analysis*. Routledge.

Othman, S., Steen, M., & Fleet, J.-A. (2020). A sequential explanatory mixed methods study design: An example of how to integrate data in a midwifery research project. *Journal of Nursing Education and Practice*, *11*(2). https://doi.org/10.5430/jnep.v11n2p75

Otte, F. W., Millar, S. K., & Klatt, S. (2021). What do you hear? The effect of stadium noise on football players' passing performances. *European Journal of Sport Science*, *21*(7), 1035-1044. https://doi.org/10.1080/17461391.2020.1809714

Papathomas, A., & Lavallee, D. (2014). Self-starvation and the performance narrative in competitive sport. *Psychology of Sport and Exercise*, *15*(6), 688-695. https://doi.org/10.1016/j.psychsport.2013.10.014

Park, J.-W., & Lim, S. (2015). A chronological review of the development of elite sport policy in South Korea. *Asia Pacific Journal of Sport and Social Science*, *4*(3), 198-210.

Peart, D. J., Balsalobre-Fernández, C., & Shaw, M. P. (2019). Use of mobile applications to collect data in sport, health, and exercise science: A narrative review. *The journal of strength & conditioning research*, *33*(4), 1167-1177.

Pereira, Z. (2011). Los diseños de método mixto en la investigación en educación: Una experiencia concreta. *Revista Electrónica Educare*, *15*(1), 15-29. https://doi.org/10.15359/ree.15-1.2

Polit, D., & Hungler, B. (2000). *Investigación científica en ciencias de la salud* (6 ed.). Editorial McGraw-Hill Interamericana.

Poucher, Z. A., Tamminen, K. A., Caron, J. G., & Sweet, S. N. (2019). Thinking through and designing qualitative research studies: a focused mapping review of 30 years of qualitative research in sport psychology. *International Review of Sport and Exercise Psychology*, *13*(1), 163-186. https://doi.org/10.1080/1750984x.2019.1656276

Pozo-Ayerbe, C., Escudero-Tena, A., Ibáñez, S. J., & Mancha Triguero, D. (2024). Analysis of the different winning strokes in professional padel: male vs. Female. *E-balonmano com Journal Sports Science*, *20*(3), 271-280. https://doi.org/10.17398/1885-7019.20.271

Prato, L., Ramis, Y., & Torregrossa, M. (2020). Cultural Transition and Sport Migration in Elite Sport: a Meta-synthesis. *Cultura, Ciencia y Deporte*, *15*(45), 387-400.

Pugliese, E., Forte, P., Matrisciano, C., Carlevaro, F., D'Anna, C., & Magistro, D. (2025). The Influence of Nonlinear Pedagogy Physical Education Intervention on Cognitive Abilities in Primary School Children: A Preliminary Study. *Brain Sciences*, *15*(12). https://doi.org/10.3390/brainsci15121283

Ranganathan, P., & Aggarwal, R. (2018). Study designs: Part 1 - An overview and classification. *Perspectives in Clinical Research*, *9*(4), 184-186. https://doi.org/10.4103/picr.PICR_124_18

Retamal-Munoz, C., Lirrutia-Gutierrez, S., Luis-de-Cos, I., Luis-de-Cos, G., & Arribas-Galarraga, S. (2024). Emotional physical education: impact of a program on the subjective well-being of university students. *Retos-Nuevas Tendencias En Educacion Fisica Deporte Y Recreacion*(61), 685-694.

Rezigalla, A. A. (2020). Observational Study Designs: Synopsis for Selecting an Appropriate Study Design. *Cureus*, *12*(1), e6692. https://doi.org/10.7759/cureus.6692

Rico-González, M., Arcos, A. L., Rojas-Valverde, D., Clemente, F. M., & Pino-Ortega, J. (2020). A Survey to Assess the Quality of the Data Obtained by Radio-Frequency Technologies and Microelectromechanical Systems to Measure External Workload and Collective Behavior Variables in Team Sports. *Sensors*, *20*(8), Article 2271. https://doi.org/10.3390/s20082271

Rogers, J., & Revész, A. (2019). Experimental and quasi-experimental designs. In J. Rogers & A. Révész (Eds.), *The Routledge handbook of research methods in applied linguistics* (pp. 133-143). Routledge.

Rojas-Valverde, D., Pino-Ortega, J., Gómez-Carmona, C. D., & Rico-González, M. (2020). A Systematic Review of Methods and Criteria Standard Proposal for the Use of Principal Component Analysis in Team's Sports Science. *International Journal of Environmental Research and Public Health*, *17*(23). https://doi.org/10.3390/ijerph17238712

Romann, M., Javet, M., Hernandez, J., Heyer, L., Trosch, S., Cobley, S., & Born, D. P. (2024). Longitudinal performance trajectories of young female sprint runners: a new tool to predict performance progression. *Frontiers in sports and active living*, *6*, 1491064. https://doi.org/10.3389/fspor.2024.1491064

Romeu, J., Camerino, O., & Castaner, M. (2023). Optimising Motor Coordination in Physical Education, an Observational Study [Article]. *Apunts Educación Física y Deportes*(153), 67-78. https://doi.org/10.5672/apunts.2014-0983.es.(2023/3).153.06

Rostami, M., Sedaghati, P., & Daneshmandi, H. (2025). Effects of a warm-up program on jump-landing pattern and lumbopelvic function in female basketball players with dynamic knee valgus. *Scientific Reports*, *15*(1), 27918. https://doi.org/10.1038/s41598-025-13817-3

Ruiz, J. M., Castillo, L. A., & Castillo, A. N. (2026). Validación de un método de enseñanza para iniciación del voley. *Acciónmotriz*, *37*(1), 22-46.

Salinero, J. G. (2004). Estudios descriptivos. *NURE investigación: Revista Científica de enfermería*, *7*(9).

Sánchez-Algarra, P., & Anguera, M. T. (2012). Qualitative/quantitative integration in the inductive observational study of interactive behaviour: impact of recording and coding among predominating perspectives. *Quality & Quantity*, *47*(2), 1237-1257. https://doi.org/10.1007/s11135-012-9764-6

Sánchez-Jiménez, M., Marave-Vivas, M., Gil-Gomez, J., & Salvador-Garcia, C. (2025). Building pre-service teachers' resilience through Service-Learning: an explanatory sequential mixed methods study [Article]. *Frontiers in Psychology*, *16*, Article 1568476. https://doi.org/10.3389/fpsyg.2025.1568476

Sandbakk, O., Tonnessen, E., Sandbakk, S. B., Losnegard, T., Seiler, S., & Haugen, T. (2025). Best-Practice Training Characteristics Within Olympic Endurance Sports as Described by Norwegian World-Class Coaches [Article]. *Sports Medicine-Open*, *11*(1), Article 45. https://doi.org/10.1186/s40798-025-00848-3

Sarmento, H., Martinho, D. V., Gouveia, E. R., Afonso, J., Chmura, P., Field, A., Savedra, N. O., Oliveira, R., Praca, G., Silva, R., Barrera-Diaz, J., & Clemente, F. M. (2024). The Influence of Playing Position on Physical, Physiological, and Technical Demands in Adult Male Soccer Matches: A Systematic Scoping Review with Evidence Gap Map. *Sports Medicine*, *54*(11), 2841-2864. https://doi.org/10.1007/s40279-024-02088-z

Schoonenboom, J., & Johnson, R. B. (2017). How to Construct a Mixed Methods Research Design. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, *69*(Suppl 2), 107-131. https://doi.org/10.1007/s11577-017-0454-1

Schupbach, Y. (2024). Negotiating the Space between East and West: Sport and Gender Politics in Swiss Women's Artistic Gymnastics in the Cold War Era [Article]. *International Journal of the History of Sport*, *41*(8), 760-778. https://doi.org/10.1080/09523367.2024.2384549

Scrabis-Fletcher, K., & Silverman, S. (2010). Perception of Competence in Middle School Physical Education: Instrument Development and Validation [Article]. *Research Quarterly for Exercise and Sport*, *81*(1), 52-61. https://doi.org/10.1080/02701367.2010.10599627

Sebastia-Amat, S., Pueo, B., Villalon-Gasch, L., & Jimenez-Olmedo, J. M. (2020). Anthropometric profile and conditional factors of U21 Spanish elite beach volleyball players according to playing position. *Retos*, *38*, 620-625.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin Company.

Shang, X., Zuo, W., Arede, J., & Leite, N. (2025). Using a smart app method Maturo for precisely estimating maturation status for young basketball athletes. *E-balonmano com Journal Sports Science*, *21*(3, special issue), 401-410. https://doi.org/10.17398/1885-7019.21.401

Sharma, L. R., Bidari, S., Bidari, D., Neupane, S., & Sapkota, R. (2023). Exploring the Mixed Methods Research Design: Types, Purposes, Strengths, Challenges, and Criticisms. *Global Academic Journal of Linguistics and Literature*, *5*(1), 3-12. https://doi.org/10.36348/gajll.2023.v05i01.002

Sharma, L. R., Jha, S., Koirala, R., Aryal, U., & Bhattarai, T. (2023). Navigating the Research Landscape: A Guide to the Selection of the Right Research Design. *International Research Journal of MMC*, *4*(1), 64-78. https://doi.org/10.3126/irjmmc.v4i1.51863

Smith, B., & Sparkes, A. C. (2016). *Routledge handbook of qualitative research in sport and exercise*. Routledge.

Smith, M. C. H., & Bazis, P. S. (2021). Conducting Mixed Methods Research Systematic Methodological Reviews: A Review of Practice and Recommendations [Review]. *Journal of Mixed Methods Research*, *15*(4), 546-566, Article 1558689820967626. https://doi.org/10.1177/1558689820967626

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*, 333-339. https://doi.org/https://doi.org/10.1016/j.jbusres.2019.07.039

Souza, L. C. d. R., Ribeiro Júnior, D. B., Ibáñez, S. J., Pereira, M. N. R., da Silva, G. T., Werneck, F. Z., & Bara Filho, M. G. (2025). Pedagogical Progression in Youth Basketball: Impacts on Training Load, Development and Health Outcomes. *Sports*, *13*(8). https://doi.org/10.3390/sports13080265

Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British journal of educational psychology*, *75*(3), 411-433.

Streetman, A. E., & Heinrich, K. M. (2024). Female empowerment through sport: an exploratory narrative review. *Sport in Society*, *27*(5), 804-819. https://doi.org/10.1080/17430437.2023.2270443

Sullivan, S. (2019). Single, separate or unified? Exploring Christian academicians' views of the body, sport and religious experience. *Sport in Society*, *22*(2), 311-325. https://doi.org/10.1080/17430437.2017.1360584

Teixeira, J., Mesquita, I., & Farias, C. (2025). Scaffolding Preservice Teachers' Use of Models-Based Practice in Physical Education: A Participatory Action Research. *Journal of Teaching in Physical Education*. https://doi.org/10.1123/jtpe.2025-0125

Telama, R., Yang, X., Viikari, J., Valimaki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: a 21-year tracking study. *American Journal of Preventive Medicine*, *28*(3), 267-273. https://doi.org/10.1016/j.amepre.2004.12.003

Thomas, J. R., Silverman, S., & Nelson, J. (2015). *Research methods in physical activity* (7 ed.). Human Kinetics.

Tobi, H., & Kampen, J. K. (2018). Research design: the methodology for interdisciplinary research framework. *Quality and Quantity 52*(3), 1209-1225. https://doi.org/10.1007/s11135-017-0513-8

Torrebadella-Flix, X. (2020). La historia del rugby en España. 1ª parte. De los inicios del juego hasta 1923. *E-balonmano com Journal Sports Science*, *16*(3), 179-202.

Torrebadella-Flix, X. (2024). La historia del rugby en España, IIª parte. De 1924 hasta la II República. *E-balonmano com Journal Sports Science*, *20*(1), 81-102.

Trejo-Silva, A., Bonjour, C., Dol, G., & González-Ramírez, A. (2022). Análisis de los lanzamientos en balonmano playa durante el Mundial Femenino Kazán 2018. *E-balonmano com Journal Sports Science*, *18*(1), 13-24.

Turner, M. J., Frost, N., Outar, L., O'Connor, H., Toth, R., Toth, L., Chadha, N., & Wood, A. G. (2025). Rational Emotive Behavior Therapy for exercise: examining self-determined motivation, alongside readiness, confidence, and motivation to exercise. *Frontiers in Psychology*, *16*, 1557885. https://doi.org/10.3389/fpsyg.2025.1557885

Ulset, V. S., Oppici, L., Hamre, K., Rudd, J. R., Stornaes, A. V., Haraldsen, H. M., & Safvenbom, R. (2025). Inclusion in Motion: Promoting Equitable Physical Activity and Health in Childhood and Adolescence. *Children (Basel)*, *12*(7). https://doi.org/10.3390/children12070942

Varghese, K., Ranwah, B., Varghese, N., & Varghese, N. (2025). *Research methodology and quantitative techniques: A guide for interdisciplinary research*. Routledge.

Wang, Z. L., Casey, A., & Cope, E. (2025). Coach experiences of formal coach education developed by national governing bodies: a systematic review. *Physical Education and Sport Pedagogy*, *30*(3), 351-363. https://doi.org/10.1080/17408989.2023.2230235

Willig, C., & Rogers, W. S. (2017). *The SAGE handbook of qualitative research in psychology*. Sage.

Woodard, C., Engler, A., & Tarascavage, J. (2025). An Exploratory, Retrospective Study on Injury Occurrence in Triathletes and Marathon Runners. *International Journal of Sports Physical Therapy*, *20*(10), 1502-1507. https://doi.org/10.26603/001c.144831

Yalcin, I., Genc, H., Bayram, A., Sezer, B. S., Isik, O., Gumus, H., & Novak, D. (2025). The effect of an 8-week mental training program on ITN test performances of tennis players. *BMC Sports Science, Medicine and Rehabilitation*, *18*(1), 23. https://doi.org/10.1186/s13102-025-01463-1

Zach, S., Avugos, S., Bakalo-Kuffler, L., & Bar-Eli, M. (2022). Winning the second half: The perceived and actual impact of the coach's half-time speech on basketball players' performance [Article]. *International Journal of Sports Science & Coaching*, *17*(5), 953-963, Article 17479541221089743. https://doi.org/10.1177/17479541221089743

Zhong, H., Wang, D., & Qi, C. H. (2025). School-family cognitive discrepancies in the cultivation of children's interest in sports: an exploratory study based on grounded theory. *Frontiers in Public Health*, *13*, Article 1713106. https://doi.org/10.3389/fpubh.2025.1713106