

STRENGTH TRAINING WITH ADOLESCENTS IN COMPULSORY SECONDARY EDUCATION: AN EVIDENCE-BASED TEACHING AND METHODOLOGICAL GUIDE

TRABAJO DE FUERZA CON ADOLESCENTES EN LA EDUCACIÓN SECUNDARIA OBLIGATORIA: UNA GUÍA DIDÁCTICO-METODOLÓGICA BASADA EN EVIDENCIA

TRABALHO DE FORÇA COM ADOLESCENTES NO ENSINO SECUNDÁRIO OBRIGATÓRIO: UM GUIA DIDÁTICO-METODOLÓGICO BASEADO EM EVIDÊNCIAS

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ABSTRACT

This article develops an evidence-based, didactic-methodological guide geared towards the real classroom context for planning, implementing and evaluating strength training in Physical Education during Compulsory Secondary Education. Through a critical synthesis of studies on strength training in young people, the curricular elements are mapped out and the principles of strength training are operationalised in specific teaching decisions. The proposal integrates different methodological approaches, management strategies, organisation and control. Implementation models compatible with the school timetable and a set of resources and instruments for evaluation are described. The results suggest that strength training with adolescents in Physical Education is relevant and safe when it is rigorously planned, supervised and evaluated with valid evidence. The guide offers an operational and transferable framework for departments and teachers, aimed at improving the quality of the teaching-learning process and enhancing the motor skills and health of students.

Keywords: Physical Education. Strength Training. Teaching Methodology. Formal Education. Compulsory Secondary Education. Strength Capacity.

RESUMEN

Este artículo desarrolla una guía didáctico-metodológica, basada en evidencia y orientada al contexto real del aula, para planificar, implementar y evaluar el trabajo de la fuerza en Educación Física durante la Educación Secundaria Obligatoria. Mediante una síntesis crítica de estudios sobre el entrenamiento de fuerza en jóvenes, se mapean los elementos curriculares y se operacionalizan los principios de entrenamiento de fuerza en decisiones didácticas concretas. La propuesta integra diferentes enfoques metodológicos, estrategias de gestión, organización y control. Se describen modelos de implementación compatibles con el horario escolar y un conjunto de recursos e instrumentos para la evaluación. Los resultados sugieren que el trabajo de fuerza con adolescentes en Educación Física es

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pertinente y seguro cuando se planifica con rigor, se supervisa y se evalúa con evidencias válidas. La guía ofrece un marco operativo y transferible para departamentos y docentes, orientado a mejorar la calidad del proceso enseñanza-aprendizaje y a potenciar la competencia motriz y la salud del alumnado.

Palabras clave: Educación Física. Entrenamiento de Fuerza. Metodología Didáctica. Educación Formal. Educación Secundaria Obligatoria. Capacidad de la Fuerza.

RESUMO

Este artigo desenvolve um guia didático-metodológico, baseado em evidências e orientado para o contexto real da sala de aula, para planejar, implementar e avaliar o trabalho de força na Educação Física durante o Ensino Secundário Obrigatório. Através de uma síntese crítica de estudos sobre o treino de força em jovens, são mapeados os elementos curriculares e operacionalizados os princípios do treino de força em decisões didáticas concretas. A proposta integra diferentes abordagens metodológicas, estratégias de gestão, organização e controlo. São descritos modelos de implementação compatíveis com o horário escolar e um conjunto de recursos e instrumentos para a avaliação. Os resultados sugerem que o trabalho de força com adolescentes na Educação Física é pertinente e seguro quando planeado com rigor, supervisionado e avaliado com evidências válidas. O guia oferece um quadro operacional e transferível para departamentos e professores, orientado para melhorar a qualidade do processo de ensino-aprendizagem e potenciar a competência motora e a saúde dos alunos.

Palavras-chave: Educação Física. Treino de Força. Metodologia Didáctica. Educação Formal. Ensino Secundário Obrigatório. Capacidade de Força.

1 INTRODUCTION AND JUSTIFICATION

This guide aims to help Physical Education (PE) teachers in Compulsory Secondary Education to integrate the work on the ability of the force with adolescents in a safe and effective way, aligned with the curriculum and with the reality of the classroom. It is a practical manual, an evidence-based toolbox, for planning, implementing, and evaluating this content with clear criteria of progression, safety, and inclusion.

Adolescence is a key vital stage in establishing healthy lifestyle habits that are maintained in adulthood, including physical activity aimed at the development of strength (Smith et al., 2014; Lloyd et al., 2014, Arce-Larrory, Velasco, & Sáez, 2025). Incorporating the work of this ability in adolescents has been associated with improvements in motor performance and general physical condition, as well as better academic performance and psychosocial benefits (self-esteem, self-concept, and social skills), without increasing the risk when performed with good technique, progression, and adequate supervision (Behringer et al., 2010; Faigenbaum et al., 2009; Stricker et al., 2020). In addition, the improvement of muscle condition is related to more favorable cardiometabolic profiles and lower percentages of fat tissue in the school population, which supports its preventive value from an early age and plays a protective role against diseases associated with a sedentary lifestyle or obesity (Casas et al., 2018; Smith et al., 2014).

The false belief that strength training damages developing tissues or stops growth has been refuted by scientific evidence in the area of research; with qualified supervision, attention to technique, and progression, strength work is safe and effective in children and adolescents (Faigenbaum et al., 2009; Lloyd et al., 2014; Stricker et al., 2020). The most recent studies show that the variables that condition the dose (intensity, volume, frequency, etc.) explain the efficacy and safety with which this capacity is worked on and explain the physiological adaptations observed in young people, at ages compatible with the educational context (Wu et al., 2021).

In the curricular field, PE aimed at the development and improvement of physical condition is aligned with the curricular objectives, since, among others, they promote the comprehensive well-being of students (MEFP, 2022). In addition, the literature indicates that strength work is compatible with and positively affects other objectives and competencies, such as attention or commitment to the task (Robinson et al., 2022; Pérez-Ramírez et al., 2025). However, the management of methodological elements (contents, progressions, load control, assessment, etc.) continues to be a challenge for teachers of this subject, which

justifies the development of a teaching guide based on recent evidence (Lloyd et al., 2014; Wu et al., 2021).

2 THEORETICAL FRAMEWORK

The object of study is the methodology of the work of the capacity of the force in PE in Compulsory Secondary Education. Therefore, we begin by defining the main concept, strength. Muscle strength is understood as the ability of the neuromuscular system to generate tension and overcome or resist a load; it is a central component of health-related fitness at all life stages (Smith et al., 2014; Lloyd & Oliver, 2012). Bompa (1983), a pioneer of the theory of training periodization, defined strength as "the neuromuscular ability to overcome external or internal resistance, through a static or dynamic muscle contraction".

From a biological and motor learning perspective, the first adaptations in response to strength work in adolescents are predominantly neuronal, that is, they occur through improvements in intra- and intermuscular coordination, recruitment and synchronization of the central and peripheral nervous system. On the other hand, structural gains, such as hypertrophy (increased size of muscle fibers; Schiaffino et al., 2021), occur to a lesser extent and depend on the accumulated workload (Behringer et al., 2010; Faigenbaum et al., 2009). These stimulus-response mechanisms are framed in the basic principles of training (individualization, progressive overload, specificity...), which explain the improvement of neuromuscular function and validate the work on strength capacity as training content (Lloyd et al., 2014).

Once the content (the capacity of the force) has been defined, the methodology is defined. A distinction can be made between training methodology and educational or didactic methodology. In training sciences, methodology refers to the set of principles, methods, and ways of organizing work over time to bring about the desired adaptations (Bompa & Buzzichelli, 2019; Zatsiorsky & Kraemer, 2006; Haff & Triplett, 2016; Kiely, 2012). These principles are based on biological laws; They have established basic training pillars based on evidence on how the body responds. In the educational context, the methodology pursues the same rigour, but with a different purpose: the integral psycho-evolutionary development of the students. In research in the educational field, methodology refers to teaching-learning models and strategies, the pedagogical organization of tasks, feedback, evaluation... to promote curricular objectives. The objective is to learn; in the case of PE, not only the motor

or physical outcome, but also the cognitive, social, behavioral, and affective outcomes (Metzler, 2017; Mosston & Ashworth, 2008; Casey & Kirk, 2021).

Therefore, some differences can be seen between the training and educational methodology: while training seeks structural adaptation and improvement of performance, didactics prioritizes meaningful learning and competency development, which is why different evaluation systems, indicators and evidence are used to measure progress in each area (Metzler, 2017; Haff & Triplett, 2016). However, there are many points of convergence between the two, since the principles of sports training, developed below, are closely related to didactic elements present in the educational curriculum (MEFP, 2022).

2.1 PRINCIPLES OF STRENGTH TRAINING

These principles of training, specifically those related to strength training, have been researched and developed by authors such as Bompa (2019), who defined periodization as "the structure of training by phases to achieve specific objectives". The author also developed specific principles, such as progressive increase in burden or individualization. Vladimir Zatsiorsky and Kraemer (2006) contributed to the science of training from a biomechanics and physiology approach. He explained the principle of specificity, stating that adaptations are highly specific to the type of exercise performed (working strength generates hypertrophy adaptations, while practicing resistance induces other changes). These authors also studied the principle of variation, observing how when an athlete is always faced with the same stimulus, performance improvements are reduced over time, which they call *the "law of accommodation"*. These principles of training have been further researched and developed and vary depending on the author, however, 5 principles stand out that coincide in most of them:

Progressive overload: In order for adaptations to be generated, it is necessary to expose the body to increasing workloads (Bompa, 1983). If the load is constant, it may be stressful enough at first that the body needs to adapt, but if the body is able to cope with the same workload, it will have accommodated and gains will stagnate (Zatsiorsky and Kraemer, 2006). Therefore, the workload must be increasing, gradual and planned. In high performance, it is common to monitor this with technological tools that allow programming and measuring internal and external loads (speed-based training, VBT; perception of effort, RPE; automatic calculation of estimated maximum repetition...), which quantifies the real intensity and ensures the gradual increase of the load, respecting this principle (González-

Badillo and Sánchez-Medina, 2010; Foster et al., 2001). There are programs and applications designed, for example, to measure the speed of the bar or record and graph the evolution of training variables in order to check progress session by session (Balsalobre-Fernández et al., 2018; 2023; Silva et al., 2021).

Specificity: Adaptations to training are very specific (Zatsiorsky & Kraemer, 2006). This means that the body generates adaptations and improves in the direction of the stimulus it has received. If maximum strength is trained (high loads, low repetitions), the body will improve neuromuscular function, if resistance training is done (low loads, high repetitions) it will improve capillarization, cardiorespiratory capacity... not only in terms of intensity and duration, but also in terms of the movements performed, the muscles involved, ranges of motion, context... (Verkhoshansky & Verkhoshansky, 2011). Bompa (2019) warns that the misuse of this principle can generate imbalances, so he recommends combining it with compensatory work. In summary, training must be directed to the characteristics and context of the performance sought, while also respecting a balanced development through compensatory work.

Variation: While specificity is important, so is introducing changes or adjustments to continue stimulating the athlete's body and mind. As mentioned above, when the stimulus becomes routine, the body's response decreases (Zatsiorsky & Kraemer, 2006). This variation can occur by altering variables such as the volume or intensity of the load, exercises, order, breaks... Bompa (2019) highlights the role of this principle in the adherence and motivation of the athlete throughout the process, and again warns that variation should not be capricious, these changes should be consistent with the final goal and they must maintain or improve performance.

Individualisation: Each person responds differently to the same training, according to their genetics, age, sex, level, experience... Therefore, training programming must be adapted to the characteristics, limitations, and objectives of each person (Bompa, 2019). Consequently, each person should be treated according to their ability, potential, and experience in strength training. Self-regulation through indicators such as perceived exertion (RPE), repetitions in the chamber (RIR) or speed-based training (VBT) allow the load to be adjusted daily to the specific state of the athlete, modulating the intensity or volume of work of each session (Shattock and Tee, 2020; González-Badillo et al., 2017).

Progression and periodization: Related to the previous ones, this principle refers to the organization of training over time, following a logical sequence of contents and phases.

It's about understanding and respecting supercompensation. Haff and Triplett (2016) explain this phenomenon by pointing out that if a training load is not excessive and is compensated by sufficient recovery, the body first experiences fatigue/stress and then adapts by restoring and raising its capacity above the initial one. Bompa (2019) defines periodization as the structured application of supercompensation in training cycles. These cycles can be divided into macrocycles, mesocycles, and microcycles, each with its specific goals. In high throughput, digital records and longitudinal metrics are used to coordinate and readjust microcycles and mesocycles with supercompensation and avoid overloading. These tools make progression measurable and comparable (Foster, 1998; Foster et al., 2001). In short, this principle guarantees that the training progresses in a systematic and orderly manner, avoids overloads and allows a controlled management of the training variables.

2.2 TRANSFER OF THE PRINCIPLES TO THE EDUCATIONAL FIELD.

It is crucial in this guide to study how these principles of strength training can be transferred to the design of didactic programs in the PE subject. Although the objective in this context is not to achieve maximum competitive performance, for an adequate development of the work of physical capacities, specifically strength, the same physiological and pedagogical foundations must be applied with the students. As mentioned, strength work improves the general health of students (body composition, muscle strength, bone health, self-esteem, etc.), enhances their motor skills (running, jumping, throwing, etc.) and contributes to the development of transversal skills and competencies prescribed by the educational curriculum (Faigenbaum et al., 2009; Smith et al., 2014; American Academy of Pediatrics Council on Sports Medicine and Fitness, 2008; Chaabene et al., 2025). Evidence suggests that we should incorporate tasks that respect the principles of training (National Committee of Child and Youth Sports Medicine, 2018). For all of the above, when creating strong didactic programs in PE, the teacher must incorporate:

Overload and gradual progression: Like athletes, students need to face increasing challenges to improve their strength. This means that over the course of the sessions the difficulty should gradually increase, for example by slightly increasing the load through the external weight used, repetitions, speed of execution or technical complexity. It is essential to start with light loads that allow you to internalize the technique correctly and make it more demanding as you adapt. A common mistake in traditional teaching is to repeat the same exercises at the same intensity throughout the year; Planning a didactic program means

taking into account adaptations and ensuring progress. As indicated, there are applications to measure and record repetitions, loads, RPE, execution speed, or automatically calculate the estimated maximum repetition (Jastrow et al., 2022; Gil-Espinosa et al., 2022; Sousa et al., 2023). This facilitates the formative assessment of the teacher and connects with the digital competence and the Personal, Social and Learning to Learn Competence (CPSAA) of the curriculum (MEFP, 2022).

Sequencing: The logic of the periodization of the training variables can be adapted to a didactic program, structuring it by phases, each with emphasis on different physical and pedagogical aspects. For example, the didactic unit could begin with the anatomical adaptation phase (Bompa's term), where the objective is to prepare the organism and internalize the basic patterns of movement; then move on to a developmental phase, where the objective is to increase the intensity with more demanding exercises or gradual increase in load; and end with an application phase, where these strength improvements are integrated and manifested in activities or games to feel and measure progress. This type of cyclical structure allows logical continuity to be maintained. Bompa indicates that planning with phases with specific objectives optimizes strength development. To this end, the use of digital notebooks or tracking apps is associated with functional and physical condition improvements (Mateo-Orcajada et al., 2024). In addition, it is consistent with the pedagogical principle of gradualness in the curriculum.

Specificity: As in the previous point, it seems obvious that as with athletes, respecting the principle of specificity implies that, if we want to improve strength, we must focus on the specific work of this ability. But in traditional educational practice, it is usually worked on indirectly (for example, by playing games that involve jumping, carrying classmates, throwing...) Evidence suggests that we should incorporate tasks that respect the principles of training (National Committee of Child and Youth Sports Medicine, 2018).

Individualisation and attention to diversity: In secondary school students, the maturity, skills and physical condition of each student vary greatly. Bompa and Lloyd suggest adapting exercises and loads to these differences. In programming, this is reflected, for example, by offering different exercises in progression of a movement pattern. Instead of simply proposing a free squat with weight, you can propose a box squat, weightless free squat, weighted squat, jump squat, static lunge, Bulgarian squat... that is, to offer the possibility for each student to choose the degree of technical difficulty and intensity with which they are comfortable to start working on the same movement pattern. In this way, the whole

group will be working, progressing the squat pattern and reaching high degrees of effort, respecting the characteristics and limitations of each one (Lloyd & Oliver, 2012). Other aspects such as speed of progression should also be individualized: some students will progress faster, while others will stay on the same exercise or external load for more sessions (Lloyd & Oliver, 2012). To measure and adjust the process individually, scales such as the RPE, mentioned above, recorded through self-recording applications, are very useful, favoring inclusion, autonomy and metacognition (Foster et al., 2001; Jastrow et al., 2022). In short, respecting this principle not only favours the effectiveness of the programme at the performance level, but also coincides with the principle of attention to diversity and contributes to inclusion, elements that must be present in all didactic programmes according to the official curriculum (Ministry of Education and Vocational Training [MEFP], 2022).

Variety and motivation: Generating and maintaining interest in students is essential. The theory of sports training indicates that variation helps not only physically, but also psychologically, monotony and boredom can negatively affect motivation and performance (Bompa, 2019). In the classroom, games, circuits, seasonal work, team competitions, use of technologies or different materials can be used to work on this content in a dynamic and fun way (Ortiz-Zorrilla et al., 2023; Vanaclocha-Amat et al., 2025). However, this variety or dynamism should not be chaotic, because continuity must be maintained and practice must be systematic in order to achieve and measure progress (Viciana Ramírez, 2002).

Recovery and safety: On the one hand, it is essential to respect recovery. In elite competitors, days of absolute or active rest are planned to allow the tissues and nervous system to recover, thus producing supercompensation (Vargas Molina, 2024). Transferred to the school context, the PE subject is taught 2-3 days a week, which leaves intermediate days for recovery. Within the same session it is also important to alternate intense efforts with rest breaks. For example, strength circuits by stations in which upper and lower body movements alternate. On the other hand, safety is a priority, and more so in the educational field where the main objective is the teaching-learning process and performance takes a back seat. Most muscle and joint injuries are due to poor load management or improper methods, where you do not recover sufficiently after periods of stress and fatigue caused by training (Porta and Miquel, 1990). To avoid these overloads, the external load used in the exercises must be conservative and progressive, prioritizing the execution technique and respecting the anatomical adaptation phases proposed by Bompa (2019).

In conclusion, and as mentioned above, the training methodology and the educational methodology have several points of convergence. There is a direct relationship between the principle of progressive overload and the concept of "didactic gradualness"; the principle of specificity with curricular alignment; or the individualization of training with attention to diversity, so present in the education law (Lloyd & Oliver, 2012). Therefore, teaching strength in PE requires respecting the principles of training, applying didactic models or strategies that promote the teaching-learning process of students (Bompa & Buzzichelli, 2019; Casey & Kirk, 2021; Metzler, 2017).

3 CURRICULAR ALIGNMENT

This teaching guide, and specifically this section, aims to offer a transferable framework that allows any teacher to align their programming with the curriculum and regulations to which they have to adapt. The elements presented below are indicative and must be adapted and contextualized to each educational reality, taking into account the regional and school regulations (PCC/PEC), the availability of resources and times, the characteristics of the group and the specific needs of educational support. For this reason, it is based on current didactic approaches and recent evidence (proposals, interventions, reviews, etc.). on the work of the force in the PE subject, but it is not tied to a specific law. Consequently, competencies, contents, evaluation criteria and indicators are chosen as the four core curricular elements that form the universal structure applicable to any legal framework, as a common non-prescriptive framework of reference. The creation and organization of these four elements will depend mainly on the legal framework of the place where the programming is to be carried out and the methodology used in it: a teacher-led methodology, which consists of direct instruction and guided practice (Rosenshine, 2012), is not the same as the *flipped classroom*. that tries to get students to investigate outside the classroom and during school hours apply and transfer what they have learned (Bishop & Verleger, 2013; Abeysekera & Dawson, 2015), or cooperative learning, with groups, roles, peer feedback, etc. (Johnson & Johnson, 1999; Hellison, 2011). Each approach requires or prioritizes different competencies, contents, and evaluation criteria, even though they share a theme. Accordingly, the examples of competencies, content, criteria and indicators in this guide are customizable. That said, in order to work on strength in the PE subject, the following elements are proposed:

3.1 CURRICULAR ELEMENTS

3.1.1 Competencies

Competencies are performances (knowing, knowing how to do and knowing how to be), which, integrated and in a context, allow complex demands to be resolved through cognitive, procedural and attitudinal resources. They are formulated in terms of observable and transferable actions (OECD, 2005; Rychen & Salganik, 2003; UNESCO, 2015). In other words, what students should know how to do and what they are good for in their real lives. In the case of strength work in PE they can be:

- C1. Health and active habit.** Integrate force work regularly and safely.
- C2. Motor literacy.** Execute basic movement patterns (pushing, pulling, squats...) with technical quality.
- C3. Self-regulation and use of data.** Plan, measure, and adjust workload.
- C4. Collaboration and *feedback*.** Cooperate, communicates technical corrections in an assertive way.
- C5. Safety.** Applies warm-up, peer supervision, and space and material standards.
- C6. Physical culture and equity.** He values strength for all people, he questions stereotypes.
- C7. Digital competence.** Use tools to plan, record, and measure progress.

3.1.2 Contents

They constitute the set of knowledge, skills and attitudes necessary to build competencies. They are chosen based on their relevance to favor their transfer and are organized around key ideas that sustain the desired performance (Wiggins & McTighe, 2005). In other words, they are the bricks that build competencies. Strength work in PE can include:

- S1. Fundamentals and health.** Benefits, recovery, sleep.
- S2. Safety.** Warm-up/activation, execution technique, supervision, order, risk detection, first aid.
- S3. Principles of training.** Specificity, progressive overload, variation, individualization.
- S4. Load control.** Volume, intensity, frequency.
- S5. Planning.** Microcycle, logging, review.
- S6. Inclusion.** Adaptations, context, limitations, functional diversity.
- S7. Digital competence.** Performance logging, apps, data management.

3.1.3 Evaluation criteria

They are clear descriptors of what counts as a learning achievement. They should refer to the quality of performance (not just the task), be useful for formative assessment, and be anchored in expected learning outcomes (Black & Wiliam, 1998; Brookhart, 2013). The criteria must be aligned with the activities of the teaching-learning process to reinforce the coherence of the curriculum (Biggs, 1996). In other words, the criteria indicate how to know if the contents and competencies have been achieved. In the case of strength work in PE, they can be:

- E1. Plan** coherently and justify decisions.
- E2. Execute** the basic movement patterns with correct technique.
- E3. Apply** security measures.
- E4. Records** and adjusts the load based on self-managing data (RPE, RIR).
- E5. Evidence of** technical or functional progress.
- E6. Collaborate** and communicate feedback assertively.
- E7. Propose** inclusive adaptations.

3.1.4 Indicators of achievement

The indicators describe measurable and observable evidence consistent with the competencies, contents, and evaluation criteria. In PE, the literature recommends that these should not be limited only to assessing motor competence, but also contemplate processes and behaviours related to involvement, co-assessment, self-regulation, etc. to improve the teaching-learning process (López Pastor, 2006). For the work of this content in PE and in coherence with the rest of the curricular elements, they can be:

- I1. Coherent planning (E1):** plans sets, repetitions and load coherently according to the objective, justifying their decisions.
- I2. Proper Technique Playing (E2):** Maintains alignment, full range of motion, and confident rhythms; applies corrections listed in the rubric.
- I3. Safety in practice (E3):** Warms up, keeps the space and material tidy, supervises their classmates and corrects risky behaviors.
- I4. Load adjustment (E4):** Records the perceived effort and modifies the repetitions or load in the next series or session according to the data and teaching indications.
- I5. Technical or functional progress (E5, E2):** Evidence of improved performance or technical control.

16. Collaboration and feedback (E6): Actively participates in co-evaluation, provides specific and respectful feedback, and accepts corrections.

17. Inclusive adaptation (E7): Proposes and applies at least one effective and safe adaptation (of load, range, support or material) for themselves or for a partner.

3.2 CURRICULUM ALIGNMENT MATRIX

Table 1

Competencies (C)	Contents/knowledge (S)	Criteria (E)	Indicators (I)
C1, C3, C7	S3, S4, S5, S7	E1	11. Coherent planning (E1): plans sets, repetitions and load coherently according to the objective, justifying their decisions.
C2, C5	S2, S5	E2	12. Proper Technique Playing (E2): Maintains alignment, full range of motion, and confident rhythms; applies corrections listed in the rubric.
C5	S2	E3	13. Safety in practice (E3): Applies warm-ups, keeps the space and material tidy, supervises their classmates and corrects risky behaviors.
C3, C7	S4, S7	E4	14. Load adjustment (E4): Records the perceived effort and modifies the repetitions or load in the next series or session according to the data and teaching indications.
C2, C3	S3, S4, S5	E5, E2	15. Technical or functional progress (E5, E2): Evidence of improved performance or technical control.
C4	S2	E6	16. Collaboration and feedback (E6): actively participates in co-evaluation, provides specific and respectful feedback, and accepts corrections.
C6	S6	E7	17. Inclusive adaptation (E7): proposes and applies at least one effective and safe adaptation (of load, range, support or material) for themselves or for a partner.

Principles and methodological elements

Strength work in PE should be based on training principles, but always as a means to achieve educational ends. The methodology is the vehicle that transfers these principles while respecting the curricular objectives and the psycho-evolutionary characteristics of the students. The main methodological elements for the work of this content are developed below. In each section, the principles of training and didactic principles are related to concrete methodological decisions to be applied in the classroom. The objective is to build a methodological framework that connects theory with teaching practice and the curriculum.

3.2.1 Progression and loadouts

The **progression of loads** in the school context involves starting with moderate loads (even with one's own body weight) and gradually increasing them as students adapt and improve their muscle function. Proper load progression maximizes gains in strength and muscle function without increasing the risk of injury (Moreno-Torres et al., 2025). For example, on an 8-week schedule, progressively increasing the weight lifted or the number of repetitions produces similar improvements in strength and hypertrophy. Both strategies are effective in the short-medium term (Plotkin et al., 2022), so in a teaching unit of similar duration it can be a simple way to respect this principle.

Individualization plays a fundamental role, both at the training level and in the classroom. Each student starts with a different level, so the exercises and loads must be adapted to their abilities. The same increase in load can be appropriate for one and excessive for another, therefore, the teacher or the students themselves must adjust the demands in a personalized way. It is recommended to continuously assess the technique and response of each student to decide when and how much to increase the load or complexity of the exercise. This ensures that progressive overload is applied effectively and safely for all students (Moreno-Torres et al., 2025).

The way to apply the principle of **specificity** in the classroom is by respecting the fact that the adaptations we seek to generate are specific and in response to the stimulus we are giving to the body. In practice, and from the point of view of teaching methodology, it implies that, if the aim is to evaluate the progress of a specific movement, for example, the squat, students must systematically repeat that movement during programming. This does not mean that the entire student group must necessarily work on the same movement, nor that each student practices a single movement. It all depends on the methodology used, but for

example, in case of working in groups, each group can choose four movements, and work on them, each member with their respective exercises and loads, depending on the level. Alternatively, each individual chooses an exercise from each basic movement pattern (pushing, pulling, etc.) and progresses through these exercises during the lesson, to measure progress by comparing initial and final performance. In this way, the teacher applies the overload to the specific objective of each student, aligning the principle of specificity with the methodological progression.

Likewise, variation helps to avoid stagnation and maintain student motivation. Varying the exercises, the order or the type of stimulus throughout the sessions introduces new stimuli without losing progression. For example: vary the material with which we add external load (switch between elastic bands and weights), work with different ranges of repetitions (one week with low repetitions with a higher load and another with high repetitions with a lower load) or rotate between different exercises of the same movement pattern (to improve strength in horizontal thrusts, work with both push-ups and dumbbell flat press). This **periodization or sequencing**, in the school context and at the methodological level, entails dividing the programming into different phases, where each one introduces these increases in load, increases in difficulty, rotation between different exercises or variation of material (Moreno-Torres et al., 2025) to ensure that the principles of the training fit with the didactic ones, and this union is coherent with the curriculum.

3.2.2 Monitoring and Security

Guaranteeing supervision and security during the sessions of the subject is a priority. Recent evidence debunks past myths and confirms that supervised strength training is not only safe, but also beneficial in adolescents (Faigenbaum et al., 2016). In fact, it has been shown that strength programs in school-age children do not increase the risk of growth or injury if the training principles developed above are followed (Moreno-Torres et al., 2025). Therefore, the role of the teacher during the sessions, especially as a supervisor, is essential to guarantee safety.

The organization of the class has an influence. Various intervention studies indicate that PE teachers have difficulty providing individualized feedback to all students when working on this content. Therefore, with large groups it is important to plan how to monitor the whole group. An appropriate strategy for this is that the work is in pairs or trios, where while one executes the exercise, there is another or several equals observing and assisting.

This system increases security as it allows there to always be immediate supervision and support to the performer. It also encourages cooperation and responsibility. It is also advisable to instill a culture of active safety in students, teaching them to listen to the body, report discomfort and not compete with each other to lift more weight. All these measures, including safety rules (do not leave material on the floor, use of weights, maintain safety space...), must be clear and consistent; A climate of order and security helps to prevent accidents.

3.2.3 Didactic styles and approaches

The teaching style and pedagogical approach is key when programming a teaching unit, as it influences motivation, adherence and the achievement of the objectives set out in it. Everyone has a place, from traditional direct instruction to innovative approaches such as cooperative learning, project-based learning or gamification, each with its advantages and disadvantages. However, recent studies indicate that in PE, traditional teacher-centred models can generate monotony and limit student involvement, while innovative, more interactive approaches increase enjoyment, involvement and motivation (Ginanjari et al., 2024).

Direct instruction is the most traditional approach where the teacher can guide the group simultaneously, demonstrating the technique of executing the exercises, establishing repetitions or objectives and correcting from the front (Olate Pastén et al., 2022). The purpose of this approach is to secure the task through explicit instruction and constant support (Guzmán & Payá, 2020). It has the advantage of being able to assist and supervise the whole group at the same time and standardize certain minimum content that everyone does. It also allows a lot of influence on the technique of execution of the exercises and that the students quickly live the experience of following a technical progression or a progressive overload. So it can be an appropriate approach for the start of programming. However, in order to achieve meaningful learning, and once a technical basis has been consolidated, it is recommended that students be given the leading role in the process through approaches that require greater involvement (Murrieta Ortega, 2023). This involvement can be promoted by encouraging peer-to-peer interaction.

In the **cooperative learning** model, work is done in groups to achieve common goals and has been shown to be effective in improving motor and social skills in PE, as well as increasing interest in activities (Zhou et al., 2023; Stanne et al., 1999). In strength work, this

model could be applied, for example, and in a summarized way, through the following challenge for the whole group: in trios, each member chooses four exercises (two lower body and two upper body). In the first session, each group should learn about the correct technique of their movements and help each other to perfect it, and during the next 3 sessions the sum of improved repetitions among all the members of the group and, in turn, among the whole class, should be greater than in the previous session. So that the whole group works together to overcome the improved total repetitions of the previous session, they help each other so that their group mates execute the movements well and we avoid monotony because each session becomes more demanding than the previous one. In addition, the training principles (individualization, progressive overload, specificity and variety) have been respected.

Project-based learning (PBL) consists of involving students in projects where they must apply the content to solve a problem or create a product (Ginanjar et al., 2024). In this case the project could be to design a strength training routine for someone who wants to improve their vertical jump, for example. Then carry out that routine by all the members of the group and finally present the whole process and the results. This approach increases autonomy and generates more significant learning, enhancing motivation. Studies have shown that PBL in PE increases students' sense of purpose and engagement compared to more traditional approaches (Ginanjar et al., 2024).

Gamification is an approach that incorporates playful or gameplay elements (challenges, rewards, levels, points, stories) into sessions to make them more engaging. This style has gained momentum in the last decade, as abundant evidence has emerged on its effectiveness in improving motivation and commitment (Arufe-Giráldez et al., 2022). For example, a strength circuit can be gamified, like a gymkhana, by groups, where points are obtained or missions are unlocked through the correct technical execution of different exercises. And in relation to the training principles, gamification favors variation, since by converting the exercises into games, different dynamics are introduced (the degree of effort, the exercises or the context varies). It also favors progressive overload, for example, if by accumulating progress you get points and level up. The principle of individualization must also be taken into account, since a good gamification design allows different ways to achieve the final goal of the game and guarantee inclusion (Castelo Barreno, Aguilar Quevedo, & León Intriago, 2025).

In short, to work on the capacity of strength in PE, styles and methodological approaches must be chosen or combined according to the objectives set and the

characteristics and limitations of the group. Research shows that student-centred models (cooperative, PBL, gamification) enhance autonomy, interaction and enjoyment (Guzmán & Payá, 2020; Ginanjar et al., 2024; Arufe-Giráldez et al., 2022), but this does not imply ruling out direct instruction, since, as seen above, it can be optimal for certain moments of programming.

3.2.4 Load Control

Load control in strength sessions in PE is an essential methodological element to ensure that the appropriate intensity is being applied without increasing the risk. In the educational field, it is not convenient to handle maximum loads nor is it easy to make measurements of 1RM (maximum repetition). Therefore, it is preferable to use more practical indicators such as time under tension, the external load used, the number of repetitions performed or effort perception scales to measure and dose the workload.

To dose the load over **time**, the durations for performing the exercises or work intervals must be established. For example, instead of prescribing 15 repetitions, it can be doing push-ups for 20 seconds. Time is a variable and easy to manage for both teachers and students. In addition, it allows each student to adjust the intensity to their level in certain exercises (in 20 seconds someone stronger will do more repetitions of squats than someone less strong), both having worked the same time and without feeling singled out for not having reached a number of repetitions. Studies of interventions with adolescents show that working on strength in circuits with gradual increases in working time generates significant adaptations at the level of strength (Moreno-Torres et al., 2025).

The classic and most common dosage format for work in strength training is **external loading** and **repetitions**. In the school context, defining a number of repetitions helps to simplify and specify the task. The external load is also easily manageable to intensify the work based on the teacher's supervision or through the effort perceived by the students: if the 10 scheduled repetitions have been completed easily, we increase the external load; If, on the other hand, the exercise technique cannot be performed properly or a certain loss of control of the movement is felt, we lower the external load. After measuring the initial performance of each student, a progression in repetitions with the same loads can be proposed in the following sessions. In addition, this dosing route can be combined with systems of **subjective perception of effort** such as RPE or RIR.

Ratings of Perceived Exertion (RPE) and Repetitions In Reserve (RIR) scales are subjective ways of quantifying intensity. On the one hand, the RPE consists of the performer himself identifying the effort involved in performing the exercise, scoring on a scale from 0 to 10 (RPE 0 zero effort and RPE 10 maximum effort). On the other hand, the RIR is the additional repetitions that the performer estimates that he could have completed before failing (if he could not have done any repetitions plus RIR 0, and if he could have done 4 repetitions plus RIR 4). The use of these tools in young people has proven to be as effective as working with fixed percentages of the 1RM, in addition, they promote reflection, self-perception and autonomy (Plotkin et al., 2022).

In short, by using the most appropriate method for each case or combining the control methods developed in this section, the teacher has an arsenal of tools to dose the training load during the sessions.

3.2.5 Integration of technological resources

The integration of technology enriches PE sessions in general, but especially in strength work (Macedo et al., 2024). As explained above, the methodology of strength training is based on mechanisms of adaptation of the body. This makes their practice a systematic process where quantification of work and measurements are important (Rong et al., 2025). In the RT4T program, strength training in the educational context, a core and successful element was to have a mobile application with exercises, demonstration videos and recording of the evolution of performance, which was very attractive among students and encouraged adherence to the process (Kennedy et al., 2021). The use of apps in PE has been shown to promote autonomy and motivation (Martínez Martínez, 2019). These tools facilitate self-regulation and monitoring of the process, as they allow loads, repetitions or different indicators to be recorded, allowing students to be the protagonists of their own process and measure and compare their evolution (Sousa-Basto & Ferreira, 2025).

These apps allow you to carry out teaching units of a different methodological nature. For example, individually each student could create their own training schedule and carry it out in subsequent sessions to evaluate its effectiveness, which would be a challenge-based learning approach. Another option is in pairs, each one fulfills the role of coach and athlete of their partner at the same time. In the first session, it is explained how the body works in relation to strength training; in the second, couples are formed and routines are created; in the following sessions, half of them, one acts as a coach and the other as an athlete; in the

second, the roles are reversed. In short, the use of apps, a priori designed for the professional work of coaches, can be a great ally for the teacher to increase student motivation and adherence, use innovative methodological approaches that promote meaningful learning and ensure compliance with the principles of strength training.

Deployment models

Intervention programs on force work in the educational framework have used various implementation models. The success of the intervention does not depend (within certain limits) on the dose format, the materials used or the methodological approaches, but on compliance with the didactic and strength training principles mentioned in the previous sections. A determining factor, according to Moreno-Torres (2023), is the training of teachers in these principles; therefore, it is key to have tools to manage these variables and their applications in the classroom.

3.2.6 Dosage Formats

In terms of the frequency, duration, volume and intensity of the sessions, 6-8 weeks of intervention are recommended to obtain sustained adaptations (Moreno-Torres, 2023). The optimal weekly frequency is between 2 and 3 sessions per week, preferably on non-consecutive days to facilitate recovery (Peinado-Rincón, Mora-Murillo, & Hutchison-Salazar, 2024). In each session, the usual and effective volume ranges from 2 to 4 sets of 6 to 15 repetitions per exercise (Peinado-Rincón, Mora-Murillo, & Hutchison-Salazar, 2024; Moreno-Torres, 2023) and the number of exercises depends on the duration of the session. Recent studies, such as Wan et al. (2025), implemented it in 10-minute microblocks (rubber bands, self-loading and dumbbells) during PE classes and obtained significant improvements in physical condition. Other studies used blocks of 15-20 minutes and also found increases in muscle strength (Mateos-Martín et al., 2025), so short or intermediate blocks are effective. Other models propose specific teaching units dedicated exclusively to this content (Mateos-Martín, Prieto-Prieto, & López-Rodríguez, 2025; Moreno-Torres et al., 2023) with comparable results. Finally, the recommended intensity varies approximately between 60% and 85% of 1RM or a medium-high perceived exertion (Peinado-Rincón, Mora-Murillo, & Hutchison-Salazar, 2024).

3.2.7 Phased sequencing

The evidence is clear in this aspect, the order of the contents is important. It is recommended to prioritize technique and movement patterns, and then incorporate loads. Mateos - Martín, Prieto-Prieto and López - Rodríguez (2025) concludes that in the initial phase, motor learning is prioritized, that is, internalizing the technique of executing basic movement patterns with one's own body weight and with low-moderate intensity. Then, an intermediate phase in which light loads can be introduced to increase the intensity, with special emphasis on teacher or peer supervision. Finally, a development phase where the goal is to raise the intensity gradually, in which higher loads at low repetitions can be combined with more moderate loads at high repetitions. This sequencing (mobility and basic patterns → progressive overload) facilitates the gradual acquisition of physical skills and abilities.

3.2.8 Progression by course

The National Committee of Child and Youth Sports Medicine (2018) emphasizes that when planning strength programs, age and maturity should be taken into account, due to the physiological characteristics of each stage. Therefore, the curricular progression of this content throughout secondary education must be adjusted to the maturity and experience of the students. At 12-13 years old, it is recommended to prioritize work focused on motor and coordination skills, with emphasis on body self-awareness exercises. Studies agree that in this period the technique should be taught in a progressive and playful way, emphasizing postural control and body self-perception before adding high loads (León-Reyes et al., 2025). At 14-16 years of age, loads can be incorporated progressively, taking advantage of the students' greater ability to adapt and after having consolidated their coordination skills and basic technique. For the same reason, in addition to increasing the intensity, the frequency of work can be gradually increased (Mateos-Martín et al., 2025). In summary, the progression of the contents and variables (volume, frequency, intensity) depending on the educational stage is based on the same principles by which the content is programmed for any athlete, adjusting to the physiological and maturational characteristics of the students.

3.2.9 Annual programming and departmental coordination

To consolidate the work of this content, it is recommended to integrate it longitudinally into the annual planning of the department of the subject. A periodized approach with force blocks distributed throughout the course can maximize the benefits. Coordination between

PE teachers is essential to ensure the didactic coherence of the programmes. Likewise, evidence indicates that programs carried out by teachers trained in the work of strength training improve student results and satisfaction (Mateos-Martín et al., 2025). Finally, working on strength has been shown to have a positive transfer to students' academic performance in the rest of the areas (Robinson et al., 2023; Pérez-Ramírez et al., 2025; Fraile-Martínez et al., 2024). For all of the above, it is essential to coordinate strength programs in order to work on them in an orderly way and that they are integrated into the curriculum, facilitating their implementation and their transfer to healthy lifestyle habits in students.

Evaluation Resources

Assessment must be supported by tools that allow assessing both technical performance or physical progress, as well as comprehensive conduct during the student's teaching-learning process, including self-regulation and teamwork. The elements to be evaluated depend directly on the objectives, competencies and content of the curriculum design. Therefore, instruments and indicators of achievement are proposed below, mainly related to the content and practice of the force's capacity.

4 ASSESSMENT INSTRUMENTS

The use of detailed **rubrics** focused on the technical quality of movements, the application of security measures or assertive communication in cooperative activities is recommended. These instruments facilitate formative assessment and coherence with the competencies, contents, and criteria provided (Black & Wiliam, 1998; Brookhart, 2013). Rubrics have been shown to be effective in promoting self-assessment and understanding of the expected standard (Gil-Espinosa et al., 2022).

Digital tools for recording performance and effort make it easier for students to self-assess and allow teachers to objectively measure the degree of involvement and individual progress in real time, and can be used for continuous assessment. In addition, the use of these tools enhances digital competence (Gil-Espinosa et al., 2022; Mateo-Orcajada et al., 2024).

Observation **lists** allow the teacher to measure the presence or absence of specific elements of student behavior. For example, identifying if a task is fulfilled and if you actively participate in a dynamic. Although it is more difficult to quantify the degree of mastery, it is an agile instrument for making an initial and/or final diagnosis and for conducting formative and summative follow-up (Heras et al., 2020; Caballero Martínez & López del Castillo, 2024).

Another instrument to objectively assess the evolution and degree of individual involvement are **performance tests**; simple tests can be used to assess the difference in performance between the beginning and end of the unit (Ramírez-Rubio et al., 2019).

And finally, self-assessment and co-assessment tests through **questionnaires** or rubrics are presented as effective systems to encourage self-regulation and reflection by students in PE, as they promote awareness and control of their own learning (Cañadas, 2022; González Cabrera, 2024). In addition, if they include assessments of perceived effort and session fatigue, they are useful for regulating the workload continuously (Rodríguez-Núñez et al., 2019).

5 CONCLUSIONS

This guide offers a didactic-methodological framework, aligned with the evidence to integrate force work in PE in a safe, inclusive and curricularly coherent way. Strength is not a competitive end in the school context, but a means to promote health, motor competence and meaningful learning when the principles of training are respected and translated into concrete pedagogical decisions. The basic principles of progressive overload, specificity, variation, individualization and periodization find their educational equivalent in didactic gradualness, alignment with learning outcomes, diversity of tasks, attention to diversity and phase sequencing. These convergence points allow the design of units with clear progressions, phased structures and options adapted to the level of each student, without compromising security or formative and summative assessment. The proposed curricular alignment provides a structure that can be transferred to different regulatory frameworks and realities. Methodologically, the guide shows that traditional approaches can be combined with innovative student-centred models, provided that supervision, load control and technical quality are ensured. Educational success is determined by fidelity to principles and the teaching capacity to create motivating and orderly contexts.

Regarding the limitations of this work, more studies are required in real school contexts that compare approaches, validate indicators and analyze the academic and psychosocial effects. However, the implementation of units focused on this content can face various difficulties such as the misperception of the suitability of strength training at an early age that persists in some educational contexts, limitations of space and material, as well as the lack of teacher training. Added to this is the heterogeneity of the students, both in their physical

condition and in their level of motivation with respect to this content. All of the above requires more flexible and differentiated methodological approaches.

In conclusion, strength work with adolescents in PE is relevant and safe when rigorously planned, supervised, and evaluated with valid evidence. This guide provides the key pieces for each teacher to build a program adapted to their context.

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