

Training Quality—What Is It and How Can We Improve It?

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Purpose: The concept of training quality reflects that the effect of training is dependent on more than the mere product of training load (eg, duration, intensity, frequency). The aims of this commentary are to (1) propose a practice-oriented framework to describe training quality and its general and context-dependent characteristics and (2) discuss how athletes and coaches can work to improve training quality. **Conclusions:** Training quality can be viewed from different perspectives. The holistic dimension includes the entire training process (goal setting, gap analysis, application of training principles and methods, etc), while a narrower dimension encompasses the specific training sessions and how they are executed in relation to the intended purpose. To capture the varying contexts, we define training quality as the degree of excellence related to how the training process or training sessions are executed to optimize adaptations and, thereby, improve overall performance. Although training quality is challenging to quantify, we argue that identification and assessment of quality indicators will increase our scientific understanding and consequently help coaches and athletes to improve training quality. We propose that the physical, technical, and psychological factors of training quality can be improved through an individualized learning process of systematic planning, execution, and debriefing. However, assessment tools should be identified and scientifically validated across different training sessions and sports. We encourage further interventions to improve training quality.

Keywords: performance development, training organization, coaching, sport science

Sport science has provided detailed quantitative information about *what* successful athletes across multiple endurance sports do in their training to develop sport-specific physiological capacities and performance.¹⁻⁴ Accordingly, our knowledge regarding the interplay of training-load factors such as duration, intensity, and frequency to stimulate the best possible adaptive responses has improved substantially. However, when coaches and athletes describe key factors leading to success, they often highlight *how* they work and *why* training practices are performed, indicating that the quality of the training process and execution of training sessions are key factors separating the best from the rest.³

In contrast to the large amount of research focusing on varying loading factors, the concept of training quality including definition, underpinning factors, and strategies to improve training quality, has been sparsely addressed. In their pioneering work 3 decades ago, Ericsson et al⁵ suggested that accumulated and domain-specific deliberate practice accounts for the acquisition of expert performance in sports and comparable domains. However, their approach is closely associated with training load, and a later meta-analysis demonstrated that only 18% of the variation in sports performance was explained by accumulated deliberate practice.⁶ This implies that complementary and multifaceted insights on the quality of the training process and execution of training sessions are required.

The aims of this commentary are to (1) propose a practice-oriented framework to describe training quality and its general and context-dependent characteristics and (2) discuss how athletes and coaches can work to improve training quality. Due to the limited scientific literature within this topic, this commentary is mainly based on the present authors' interpretations of best practice literature and personal communications with world-leading athletes and coaches across multiple sports.

What Is Training Quality?


Although widely used across different fields, it appears difficult to reach a unified, precise definition of what quality is.⁷⁻⁹ Nevertheless, general distinctions can be observed between *quality of a process* and *quality of results*, where the *quality of a process* includes how and why planning, preparation, and execution are performed to reach a specified overall goal. On the other hand, *quality of a result* comprises the result of a process, typically operationalized by objectively defined performance indicators in which high quality indicates a small deviation from a gold standard.

In the training vernacular of athletes and coaches, training quality can reflect different dimensions related to the long-term training process and how individual training sessions are executed. Practitioners are typically concerned about the link between the executed session and its intention, as illustrated by trail running GOAT Kilian Jornet: “. . . When I do every workout, I'm thinking why I'm doing this? What is the goal? A session is part of a plan to make physiological, technical, muscular, metabolic, or mental adaptations, so I would focus on different aspects during sessions to be sure I'm doing what I'm supposed to do. That means that in some sessions I would be focusing on the speed, on others on the

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breathing, cardio or effort, on others on the cadence, or in the feeling of regenerating, or in the technique. It is not just about training hard but trying to focus on what really matters for that specific session . . . ”¹⁰

This is in line with Shell et al,¹¹ who defined training quality as an athlete’s capacity to complete a training session to the desired level. However, we argue that training quality has (at least) 2 dimensions:

1. The quality of the holistic training process (including goal setting, gap analysis, application of training principles and methods) expresses the degree to which the training process facilitates long-term development of sport-specific requirements and the desired performance level.
2. The quality of the specific training session expresses the ability to optimize processes influencing the execution of training in relation to the intended purpose of the specific session.

These 2 dimensions of training quality are interconnected and complementary; the aim of the training process is to facilitate well-balanced and periodized training load, including repeated high-quality sessions. Subsequently, this provides stimulus for long-term adaptations and the ability to maximize performance in competitions. The second dimension, focusing on the executive quality of each session, is dependent upon a well-designed training process. In other words, one dimension is either the input or the output of the other.

Overall, the mindsets, approaches to training, and views on training quality are shaped by the varying actors’ (ie, athletes, coaches, and supporting staff) specified roles. Based on these considerations, we argue that the meaning of training quality depends on the context. This is likely part of the reason why no consensus around a clear definition of training quality has been established. Therefore, to capture the varying contexts and dimensions, we hereby define training quality as the degree of excellence related to how the training process or training sessions are executed to optimize adaptations and/or improve overall performance. Hence, high training quality over time will put the athletes in the best position to reach their competition goals.

Which Factors Influence Training Quality?

The quality of the training process and training sessions is influenced by a myriad of factors, including training load and restitution, skill set, and experience of athlete and coach, training peers, supporting staff, training environment and facilities, well-being, and life balance. High training quality can only be achieved directly by the athlete via optimal preparation (sufficient sleep, targeted nutrition, proper warm-up routines, etc), execution (individualized workouts, focus, intensity control, fine-tuning of skills in response to feedback, etc) and after sessions (reflective exploration, post-workout routines, restitution actions, etc). This requires a strong sense of ownership of the training process, motivation, dedication, determination, and training intelligence.¹²

An environment with high task-oriented learning motivation, high degree of participation and fundamental safety, and a good coach–athlete relationship is most likely a key to obtain high training quality. Here, the coach will have a particular impact via actions directed toward the athlete. Extensive sport-specific knowledge, experience, and pedagogic skills form basis for effective goal-setting processes, development of training plans, organization of training, and optimal application of basic training

principles. Via observations, measurements, and analyses of the physiological, technical, tactical and psychological domains, and continuous communication with the athlete, training plans, and sessions can be fine-tuned and adjusted for optimal adaptation.

Although a high-quality training process should facilitate that each session can be performed according to its defined intention, athletes are human beings (not machines) influenced by many factors. Accordingly, an additional skill is the coach’s and athlete’s ability to dynamically adjust both training load and intention of single sessions due to changes in mental and/or physical state. In this context, this athlete–coach interplay represents the “gold” and inner core of the training process, differentiating good from extraordinary performance development. If training quality was not an issue, the role of the coach would have been superfluous, and all athletes could have followed a one-size-fits-all approach.

Is It Possible to Assess Training Quality?

Acknowledging the holistic and multifaceted nature of training quality, quantification is challenging, and there is very limited empirical research that has attempted to measure it. Still, we argue that identification and assessment of indicators of training quality are important for at least 2 reasons: (1) to provide discussions around the impact of various factors and (2) to build a basis for coaches and athletes to further improve training quality.

Shell et al¹¹ divided quality indicators within a training session into physical, technical, and mental factors. According to the authors, understanding these respective categories must be aligned with the session intention and goal(s). In addition, our view is that determination of training quality must be specified according to sports, sessions, and individuals, either via objective or subjective assessments. Quantitative measures of training quality include quantifiable differences between intended and exerted effort (eg, how heart rate, ratings of perceived exertion, speed or power deviate from what was intended for the session), as well as the use of questionnaires, planning tools, training diaries, and so on.^{13,14} Indeed, qualitative data are more challenging to rely on due to their interpretive nature. Subjective perceptions of training quality may be unpredictable and could be affected by a myriad of related and unrelated factors to training quality itself.¹⁵

We argue that a combination of selected qualitative and quantitative indicators of training quality should be assessed and deliberately implemented in training and coaching practice. The selection of indicators must be based on a clear purpose related to the specific development goals of the athlete. Furthermore, training quality measurements must be interpreted according to the session’s intention. Within this context, experienced coaches and staff who have achieved success with multiple athletes over time are likely best qualified to judge.

How Can High Training Quality Be Developed?

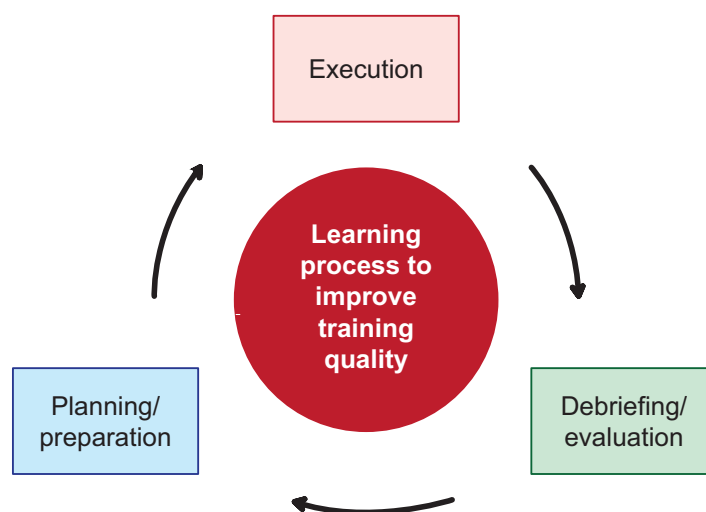
We argue that the quality of the entire training process as well as the quality of single training sessions can be developed and fine-tuned over time through optimal interactions among the athlete, coach, and supporting staff. To maximize the probability for success, it is important that athletes are affiliated with good coaches and that training quality is continuously subject to improvement through a circular learning process. The varying steps of the training process (eg, goal setting, identifying the gaps between current and desired

state, and organization and planning of training) repeat themselves, either at the macro, meso, or micro level, and learning becomes facilitated through analyses and debriefings of the performed sessions. The coach should have high knowledge and comprehensive overview of the holistic training process in terms of long-term planning, competition activity, and team management. However, the athlete is key to high quality during single training sessions, demonstrated by their ability to execute each session according to reach the intended goal.¹¹

Our experience from combined decades in elite sports is that the best practitioners have established a culture of continuous learning and development through appropriate systems and

processes. The best athletes are continuously searching for improvements, and the best coaches manage to challenge and guide their athletes in a way where training quality develops. Figure 1 exemplifies how we experience that world-leading athletes and coaches across various sports work to increase the quality of training sessions for their athletes.

In addition, we suggest a process where the athlete and coach together define the intentions of the key sessions as well as their most important quality indicators. Thereafter, they together define the required level to achieve high training quality for each of these indicators before they individually rate the current state of the athlete. Finally, they use their judgment to identify strengths and



Before the session	During the session	After the session
<ul style="list-style-type: none"> - Clarification of intention and development tasks for the session - Choice of exercise modality, duration, intensity and terrain/facility - Presence of coach and training partners - Decision of internal and external feedback to adjust execution of the session, for instance to control intensity or improve technique and tactics (e.g., heart rate, speed, lactate, RPE, video, feedback from coach and peers) - Plan for timing and amount of nutrition and fluid intake prior to, during, and after the session - Choice of equipment and clothing - Mental preparation procedures 	<ul style="list-style-type: none"> - Continuous control and micro-adjustments of training intensity - Adjustments of other loading factors and equipment, if necessary - Mental awareness and focus on pre-planned development tasks - Intake of nutrition and fluid according to plan (or necessary adjustments) - Feedback from coach and/or peers according to agreement 	<ul style="list-style-type: none"> - Initiation of the recovery processes immediately after the session (e.g., shower, dry clothing, nutrition, fluid, rest) - Immediate debriefing procedures - Evaluation of physical, technical and psychological factors: <ul style="list-style-type: none"> - Accordance between intention and execution (e.g., intensity, technical quality, focus) - Were appropriate adjustments undertaken? - Discussion of appropriate adjustments in the overall training process and for that specific type of session

Figure 1 — Illustration of a circular learning process to promote continuous improvements in training quality. Best-practice examples from world-leading endurance coaches and athletes are provided for (1) planning and preparation procedures before a training session, (2) focus areas during a session, and (3) debriefing and evaluation procedures after a session. RPE indicates rating of perceived exertion.

detect gaps between the current and required level leading to the development of goals for further improvement of training quality. Although we argue that the described quality dimensions can be improved through such an individualized learning process, we emphasize that neither the assessment tools nor the employment of such methods have been scientifically validated.

Practical Applications

Successful athletes and coaches consider training quality highly important for performance development in sports. In this commentary, an attempt has been made to address some fundamental questions related to this topic: What is training quality? Which factors influence training quality? Is it possible to assess training quality? How can high training quality be developed? Although the content of this practical-oriented framework must be interpreted with caution, we intend to provide a point of departure and encourage future studies to explore training quality more in detail.

Conclusions

Training quality can be viewed from different perspectives. The holistic dimension includes the entire training process, while a narrower and more reductionistic dimension encompasses the specific training sessions and how they are executed in relation to the intended purpose. To capture the varying contexts, we have defined training quality as the degree of excellence related to how the training process or training sessions are executed to optimize adaptations and/or improve overall performance. We argue that an environment with high task-oriented learning motivation, continuous and dynamic athlete–coach interaction, and athlete ownership and dedication in planning/preparation, execution, and debriefing/evaluation are considered particularly important to develop high training quality.

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