

# A Longitudinal Study on the Role of Long-Term Badminton Training in Shaping the Willpower of Adolescents

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**Abstract:** Sports activities constitute a key context for shaping non-intellectual factors in adolescents, particularly their volitional qualities. Due to its characteristics of high-intensity intermittent nature, technical complexity, and rapid decision-making, badminton provides a structured vehicle for the cultivation of volitional qualities. This study adopts a longitudinal design to systematically investigate the intrinsic mechanisms and dynamic processes underlying the influence of long-term badminton training on the development of volitional qualities in adolescents. The research finds that there exists a multidimensional alignment between the traits of the sport and the dimensions of volitional qualities; long-term structured training loads, by creating progressive challenges, systematically foster psychological resilience; repetitive skill refinement and the formation of self-discipline follow a synergistic developmental pathway. The shaping of volitional qualities exhibits dynamic evolution, progressing through stages from initial establishment of self-awareness, to the development of tenacity in the mid-term, and finally to long-term internalization and transfer. The study further reveals that individual psychological foundations play a moderating role; coaching feedback requires stage-specific alignment; and social comparison influences self-construction through the mediating effect of achievement attribution. This research provides a theoretical basis and practical reference for understanding the specific pathways through which sports promote psychological development.

**Keywords:** long-term badminton training; adolescents; volitional qualities; longitudinal study; psychological resilience; self-discipline

## Introduction

Adolescence represents a critical stage for the formation and consolidation of an individual's volitional qualities. How to effectively promote their positive development within organized educational activities is a subject worthy of in-depth exploration. Sports activities, especially specialized training requiring long-term and systematic commitment, are regarded as a significant pathway for cultivating qualities such as perseverance, self-discipline, and resilience in adolescents. Badminton, with its unique composite demands on physical fitness, skill, and psychology, constitutes a potentially effective interventional vehicle. However, existing research predominantly focuses on the effects of short-term training or cross-sectional comparisons, lacking longitudinal and systematic revelation of the dynamic processes, intrinsic mechanisms, and individual differences concerning the influence of long-term training on volitional qualities. Therefore, employing a longitudinal research method to deeply analyze the internal linkage mechanisms, dynamic evolutionary trajectories, and moderating influencing factors of how long-term badminton training shapes the volitional qualities of adolescents is of clear necessity and applied value. This approach will not only help deepen the understanding within sport psychology regarding the specific pathways and conditions of "sports shaping personality," but also provide empirical evidence and theoretical guidance for optimizing the design, implementation, and evaluation of adolescent sports training systems, enabling them to more effectively serve the holistic development of participants.

## **1. The Intrinsic Connection Mechanism Between Long-Term Badminton Training and Adolescents' Volitional Qualities**

### ***1.1 Conceptual Alignment Between the Characteristics of Badminton and Volitional Qualities***

Badminton is a competitive sport characterized by its high-intensity intermittent nature, technical complexity, and rapid decision-making requirements. Its defining traits manifest as multi-shot rallies during matches, frequent offensive-defensive transitions, continuous movement and striking, alongside high demands for the precision and stability of technical actions. Within the field of psychology, volitional qualities generally refer to the stable psychological characteristics exhibited by an individual in consciously regulating their own behavior and overcoming internal and external difficulties to achieve predetermined goals. Its core conceptual framework encompasses consciousness, decisiveness, resilience, and self-control.

The characteristics of badminton align multidimensionally with the conceptual dimensions of volitional qualities. The sport's high-intensity intermittent nature requires participants to sustain a high level of concentration and effort within cycles of significant physical exertion and brief recovery, which directly corresponds to the quality of resilience within volitional traits. The complex technical system and tactical execution demand that practitioners possess a high degree of consciousness and self-control to adhere to training protocols and overcome the monotony and frustration typical of initial skill acquisition. The rapidly changing match situations necessitate players to make judgments and decisions in an instant, reflecting the quality of decisiveness within volitional characteristics<sup>[1]</sup>. Therefore, the practical context provided by badminton serves as a structured vehicle for the stimulation, experience, and refinement of the various components of volitional qualities.

### ***1.2 The Structural Impact of Long-Term Training Load on the Development of Psychological Resilience***

Long-term systematic badminton training inherently involves periodic and structured training load arrangements, encompassing both physiological and psychological loads. The physiological load manifests in the accumulation of sustained exercise volume and intensity stimulation, while the psychological load stems from the demand for technical perfection, the challenge of pushing physical limits, and the management of pressure related to competitive outcomes. The long-term application of this dual load exerts a structural influence on the development of psychological resilience in adolescents.

Psychological resilience, defined as an individual's psychological capacity to remain stable, persist in effort, and achieve goals under pressure or adversity, does not develop instantaneously. Its development occurs gradually through repeated exposure to manageable challenging situations and successful coping. The load arrangements inherent in long-term badminton training essentially create a series of progressive, controllable challenge scenarios. For instance, by gradually increasing training duration, elevating training intensity, introducing more challenging opponents, or setting higher technical goals, adolescents are consistently placed under pressure slightly exceeding their current adaptation level. Throughout this process, individuals must continually mobilize psychological resources to cope with fatigue, discomfort, and temporary setbacks. Successful adaptation and breakthroughs reinforce their cognitive schema of "effort-overcoming-growth," bolster confidence in their own coping abilities, and are thereby internalized into more stable psychological resilience. This structural influence manifests in the formation of an adaptive psychophysiological response pattern, enabling individuals to demonstrate a higher tolerance threshold and greater recovery elasticity when confronting subsequent difficulties in training or daily life.

### ***1.3 The Synergistic Developmental Pathway Between the Repetitive Skill Refinement Process and the Quality of Self-Discipline***

The refinement of badminton skills relies on extensive, repetitive, and highly focused deliberate practice. Every level of improvement, from the automation of basic movements to the mastery of advanced techniques and the automatization of tactical application, is inseparable from tens of thousands of repeated drills. This process of repetitive skill refinement shares an intrinsic synergistic developmental relationship with the cultivation of self-discipline.

The core of self-discipline lies in an individual's ability to actively regulate immediate impulses,

manage their own behaviors, and sustain persistent effort to achieve long-term valuable goals. The inherent repetitiveness of badminton skill acquisition requires practitioners to overcome the boredom that arises after the initial novelty wears off and the frustration potentially caused by technical plateaus. Persisting in such repetitive practice constitutes direct training in self-management capabilities. Individuals must set clear, phased skill objectives, schedule training time, and maintain focus and commitment to practice in the absence of immediate external rewards. This process fosters the development of self-regulation strategies such as self-monitoring, self-evaluation, and self-reinforcement<sup>[2]</sup>.

More importantly, the visible improvement in skill level achieved through repetitive practice-such as more stable strokes and quicker movement-generates positive feedback, allowing individuals to experience the direct connection between self-disciplined behavior and goal attainment. This experience deepens the cognition of the "self-discipline – effort – progress" causal relationship, thereby intrinsically motivating individuals to transform self-disciplined behavior from an external requirement into an internal principle. Consequently, the micro-process of skill refinement becomes a practical arena for shaping self-discipline; in turn, the gradually strengthened quality of self-discipline secures the sustained effort necessary for skill refinement, forming a mutually reinforcing and synergistic developmental pathway. This synergistic development is not confined to the training context; its effects may transfer to other areas of adolescents' lives requiring planning and perseverance, such as academics.

## **2. The Dynamic Evolutionary Characteristics of Volitional Quality Development During Long-Term Training**

### ***2.1 Maintenance of Initial Interest and Preliminary Establishment of Consciousness Quality in the Early Training Stage***

During the initial phase of the long-term training process, the behavioral drive of adolescent participants primarily relies on the novelty and inherent enjoyment of badminton itself, as well as possible accompanying external incentives. The focal point of volitional quality development at this stage lies in gradually transforming relatively unstable initial interest into the preliminary consciousness required to maintain regular training. The quality of consciousness manifests in the individual's ability to clarify the purpose and significance of the training activity and to guide their actions accordingly, thereby reducing dependence on external supervision. In training practice, coaches employ structured and gamified beginner exercises to lower the skill threshold, enabling participants to quickly gain successful experiences with basic strokes. Such positive experiences help reinforce participation motivation, partially channeling the feeling of "fun" towards an inclination of "wanting to do well." Simultaneously, the establishment of fundamental discipline, such as punctual attendance, adherence to session rules, and completion of prescribed practice volumes, provides a behavioral framework for cultivating consciousness. Throughout this process, individuals begin to learn how to make preliminary connections between external requirements (coach instructions, session schedules) and personal goals (learning to play, gaining recognition), attempting to act according to established plans even when immediate strong interest is lacking. At this point, the quality of consciousness is in a nascent state, relatively weak in stability and susceptible to external interference. However, its preliminary establishment lays the groundwork for the subsequent development of deeper volitional qualities<sup>[3]</sup>.

### ***2.2 Breaking Through the Plateau Phase and the Crucial Development of Tenacity Quality in the Mid-Training Stage***

As training progresses and a technical foundation is established, participants commonly enter a "plateau phase" in skill improvement. During this period, the returns from refining technical movements slow down, physiological adaptation reduces the sheer sense of fatigue from completing training volume but also diminishes the feeling of breakthrough, and the progress curve tends to flatten. Decreased motivation and increased frustration become common phenomena, marking the core stage for the crucial development of the quality of tenacity. The quality of tenacity refers to the psychological characteristic of an individual being able to persevere and persist unyieldingly in the face of difficulties, obstacles, or failure. The emergence of the plateau phase constitutes a persistent, genuine challenging situation. To break through this plateau, participants need to invest more focused, meticulous, and often repetitive and tedious effort, such as targeted strengthening exercises for weak areas and mental

engagement to deepen tactical understanding.

In this process, the individual's original motivational pattern, based on novelty and rapid progress, becomes ineffective, necessitating the mobilization of deeper psychological resources. Successfully navigating the plateau phase depends on multiple factors: the professional guidance and phased goal breakdown provided by coaches help maintain direction; deep identification with the sport and the reaffirmation of personal goals provide meaning and support; most critically, it relies on the occasional minor improvements or positive feedback obtained after repeated attempts, adjustments, and encountering minor setbacks. These experiences of "success after hardship," although occurring at longer intervals, have a significant impact on shaping psychological resilience. They modify the individual's cognition regarding the "effort-outcome" relationship, fostering an understanding of the value of sustaining effort in adversity, thereby gradually developing the tenacious trait of maintaining effort even when progress is not evident. Thus, breaking through the plateau phase represents not only a technical leap but also a substantial forging of psychological tolerance for difficulty and enduring perseverance.

### ***2.3 Long-Term Training Persistence and the Stable Internalization of Volitional Qualities***

When the training period extends to units of years, badminton becomes deeply integrated into the participant's life rhythm and self-identity. At this stage, the developmental characteristic of volitional qualities shifts from the growth of abilities to handle specific situational challenges towards the internalization of a relatively stable and automated psychological trait. The act of long-term persistence itself is the result and manifestation of the comprehensive interaction and increasing stabilization of all elements of volitional qualities. Consciousness manifests as training becoming an inseparable component of the daily schedule, with significant reduction in cognitive conflict regarding the decision to participate. Tenacity, when confronted with injuries, academic pressure, or new performance plateaus, is demonstrated through more strategic coping and faster emotional recovery.

The stable internalization of volitional qualities is manifested across several levels. At the cognitive level, value beliefs regarding effort, perseverance, and overcoming difficulties are firmly established and have become part of the self-concept. At the behavioral level, behavioral patterns such as maintaining training, managing states, and setting and pursuing goals tend toward automation, reducing the volitional effort required for each action. At the level of emotional regulation, the individual's emotional response patterns to pressure, gains, and losses in training and competition become more mature and stable. More importantly, this internalized volitional quality begins to exhibit a tendency for cross-situational transfer. Psychological-behavioral patterns shaped through long-term training—such as goal management, time planning, and adversity coping—may be applied by the individual to other life domains such as academic pursuits and interpersonal interactions. By this stage, volitional qualities have evolved from psychological resources that initially required deliberate mobilization and maintenance into a more diffuse and stable personal psychological asset, profoundly influencing the individual's behavioral style and fundamental mode of facing challenges<sup>[4]</sup>. The significance of long-term longitudinal research lies in revealing this complete dynamic trajectory from external guidance to internal construction, and from situation-specific to stable generalization.

## **3. Analysis of Individual Differences and Influencing Factors in the Development of Volitional Qualities**

### ***3.1 The Moderating Role of Adolescents' Individual Psychological Foundation on the Receptivity to Training Effects***

Before entering the long-term badminton training system, adolescent participants already possess relatively stable foundational psychological traits. These traits serve as important moderating variables, influencing the degree of receptivity and the efficiency of transformation regarding the shaping effects of the training environment on volitional qualities. Core psychological foundation variables include the individual's initial achievement motivation orientation, temperament type characteristics, and level of self-efficacy. For instance, individuals with a mastery goal orientation are more likely to perceive training challenges as opportunities for learning and growth, thereby being better able to sustain effort when encountering difficulties; whereas individuals primarily driven by performance goals may find their volitional effort more susceptible to interference from short-term evaluations of success or failure<sup>[5]</sup>.

Individuals scoring higher on the neuroticism dimension may be more sensitive to pressure and criticism during training, requiring greater cognitive regulation resources to maintain training persistence. Conversely, individuals with higher levels of extraversion and conscientiousness may adapt more readily to the structural demands of training. A higher initial sense of self-efficacy can enhance an individual's confidence in facing training loads, foster positive psychological expectations, and thereby promote a more proactive investment of volitional effort. These foundational psychological traits constitute the "filter" and "background" through which individuals process training experiences and respond to training demands. While they do not determine the absolute endpoint of volitional quality development, they significantly moderate the speed, pathway, and encountered resistance in the process from identical training stimuli to the construction of internal qualities. Consequently, even under similar training regimens, systematic differences exist in the growth trajectories and final manifested states across various dimensions of volitional qualities among different individuals.

### ***3.2 The Interactive Relationship Between Coaching Feedback Patterns Across Different Training Stages and the Development of Volitional Qualities***

Coaching feedback behavior constitutes a crucial social influence within the training environment, engaging in a dynamic interactive relationship with the development of adolescents' volitional qualities. This relationship exhibits distinct characteristics across different training stages. In the initial training stage, coaches primarily employ process-oriented and encouraging feedback, focusing on effort level, adherence to basic rules, and minor technical progress. This approach facilitates the internalization of external motivation and supports the preliminary establishment of consciousness and self-control. The timeliness, specificity, and supportive nature of this feedback effectively reduce beginners' anxiety and reinforce persistent behavior.

As training progresses into the mid and later stages, with improvements in the participants' skills and cognitive abilities, coaching feedback models need to shift towards developmental and analytical feedback. At this point, the feedback content focuses more on the analysis of technical details, the attribution of tactical decisions, and their connection to long-term goals. Coaches guide self-reflection by posing open-ended questions and attributing failures to controllable factors such as effort or strategy, rather than uncontrollable factors like innate talent or luck. This attribution training directly fosters the development of tenacity and autonomy. If coaching feedback models can align with the individual's developmental stage and current psychological needs, they can effectively scaffold the construction of volitional qualities; conversely, rigid or inappropriate feedback may undermine motivation, solidify erroneous self-perceptions, and hinder the positive development of volitional qualities.

### ***3.3 The Mediating Effect of Social Comparison and Achievement Attribution in the Self-Construction of Volitional Qualities***

Within long-term group training or competitive environments, social comparison is an ongoing, spontaneous cognitive process. Adolescent participants consciously or unconsciously compare their own skill level, rate of progress, degree of effort, and competition results with those of their peers. While this comparison process does not directly determine volitional qualities, its outcomes exert a profound influence on the self-construction of volitional qualities through the mediating variable of the individual's internal achievement attribution. When an individual attributes perceived advantages or progress from comparisons to their own stable effort and effective strategies, it reinforces their sense of self-efficacy and belief in the value of effort, thereby promoting consciousness and resilience.

Conversely, if perceived disadvantages or stagnation are attributed to uncontrollable factors such as a lack of innate ability, this is likely to lead to learned helplessness and undermine the motivation to persevere. More crucially, long-term training fosters the development of a relatively stable attributional style in individuals. Those who tend towards internal, controllable, and unstable attributions (such as effort) are better able to recover from setbacks and view challenges as obstacles that can be overcome through volitional effort, which directly shapes positive volitional qualities. Therefore, social comparison provides reference information for self-evaluation, while attributional style serves as the core mechanism for processing this information to form self-perceptions and behavioral expectations. Together, they constitute a key mediating pathway explaining how external training experiences are transformed into internal volitional qualities.

## Conclusion

This longitudinal study systematically reveals that the role of long-term badminton training in shaping adolescents' volitional qualities is a complex process involving the interaction of multiple factors and dynamic evolution. The research confirms a structural alignment between the characteristics of badminton and the dimensions of volitional qualities. It demonstrates that long-term training loads systematically promote the development of psychological resilience by creating controllable challenges, and that skill refinement and the cultivation of self-discipline form a mutually reinforcing synergistic pathway. The shaping of volitional qualities follows an evolutionary trajectory from external guidance to internal construction, and from being situation-specific to stable generalization. The key developmental stages consist of establishing initial consciousness, forging mid-term tenacity, and achieving long-term stable internalization. Individual psychological foundations, coaching feedback patterns, and attribution styles triggered by social comparison collectively moderate the effectiveness of this shaping process and contribute to individual differences.

Future research could deepen understanding in the following directions: first, employing a combination of multi-wave longitudinal designs and Ecological Momentary Assessment (EMA) methods to more precisely delineate the nonlinear trajectories and critical turning points in the development of volitional qualities; second, constructing and testing integrated intervention models that combine coaching support and psychological training, tailored to different training stages and individual characteristics; third, exploring the cognitive and neural mechanisms underlying the transfer effects of volitional qualities and their long-term impact on adolescents' general social adaptation functioning.

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