# Exploration of Teaching Principles from the Perspective of Exercise Physiology Knowledge

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**Abstract:** Exercise physiology is a science that studies functions and mechanisms, and its knowledge contains many principles and methods. These principles and methods are not only applied to the teaching of physical education classes, fitness guidance, and sports training, but also, many principles can be reflected to guide the teaching process and design of exercise physiology courses and other theoretical courses.

**Keywords:** Exercise Physiology; Knowledge; Teaching Principles

## 1. Introduction

Exercise physiology is an important applied foundational theoretical course in physical education, a branch of human physiology, and a science that studies mechanisms and principles, containing a wealth of principles and methods. It is not only applied to guide the teaching of physical education classes, fitness activities, and competitive sports training, but also, many theories can be reflected to guide the teaching process of exercise physiology courses themselves or other theoretical courses.

## 2. Excitability and Adaptability Principles in Teaching

Excitability is one of the fundamental characteristics of life, referring to the property of excitable tissues to generate excitement when stimulated. Neural tissue is excitable, and according to the principles of excitability, the human cerebral cortex works most efficiently when it is in an optimal state of excitement, which means that students are most efficient in learning when they are in the best excited state during class. However, whether the cerebral cortex can be in an optimal functional state is controlled by a combination of environmental factors. For theoretical classes in physical education majors, this is manifested by the combined influence of appropriate stimulus sources, physical fatigue, classroom environment, interest, motivation, and teaching organization. As an important basic theoretical course, exercise physiology is usually taught over a long semester, requiring 16-18 weeks to complete the teaching tasks in most colleges and universities. In the first half of the semester, students' excitability is often high due to new stimuli such as new course content, the teacher's own stimulation, and the students' own positive psychological stimulation, resulting in high excitement for both teachers and students. As a foundational subject, it is generally scheduled in the first year of college, not long after students enter college, so the entire teaching process is often passionate and highly excited, with relatively good results. However, in the second half of the semester, students gradually adapt to and tolerate the above-mentioned new and different stimuli. Without stronger or fresher stimulating factors, both teachers' teaching and students' learning will produce psychological fatigue, which is also a kind of aesthetic fatigue in teaching, thus reducing teaching effectiveness. This mechanism involves another principle of exercise physiology, namely the theory of adaptability. For the teaching of exercise physiology in the second half of the semester, how to maintain good teaching effects under the condition of students' psychological fatigue, keep the cerebral cortex in a relatively high state of excitement, and stimulate students' enthusiasm for learning is a difficult problem. Based on the physiological principles of excitability and adaptability, on the one hand, the problem can be solved from the teaching plan design, dividing the long-term course into two short terms, or dividing the content into two major sections, that is, human physiology and exercise physiology. After completing the

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teaching of one section, the next section is like opening another new course, which can effectively reduce psychological fatigue. On the other hand, it can be solved from the teacher's perspective, such as combining theory with practice in teaching content design, continuously improving teaching methods, or changing teachers for different section contents; it can also be solved from the student's perspective, such as educating students not to slacken, strengthening self-learning ability, and strengthening regular testing. In short, the principle of improvement is to increase new and different stimuli, improve excitability, and reduce adaptability.

## 3. Feedback Principles in Teaching

Feedback, originally a concept in physics, has played a significant role in explaining the regulatory mechanisms of exercise and human movement science since its introduction to the field. Utilizing feedback principles in teaching is also an effective method. Research indicates that feedback-based teaching has achieved good results in physical education technical courses. For example, Wang Hong's study on "The Construction and Empirical Evidence of Feedback Teaching Model in Sanda Teaching" demonstrates that a feedback teaching model led by teachers and centered on students is a dialectically unified system of teaching and learning interaction, which can effectively improve teaching levels and achieve teaching objectives. Integrating feedback principles into the teaching of professional theory courses is also feasible, considering the characteristics of physical education students.

Firstly, make frequent use of positive feedback. Positive feedback refers to the use of affirmative and encouraging language or measures to help students build confidence and increase their interest in learning. Students majoring in physical education typically prefer the attention of teachers. They are often engaged in outdoor, open activities, and long-term athletic training has shaped their cheerful personalities, strong self-confidence, and willingness to perform, which makes them active in theory classes. Practice has shown that teacher attention is effective in improving their excitement and enthusiasm for classroom learning. Therefore, using classroom questioning is a good way to provide feedback and attention, and it is also an effective means of supervising learning and consolidating knowledge. When questioning, providing affirmation or encouragement in positive language can greatly help to improve students' enthusiasm for learning. Additionally, since physical education students often lack a solid theoretical foundation and may lack confidence in learning theory courses, caring for students' thoughts and classroom reactions, timely ideological education and communication, and timely adjustments to teaching plans and content can all help improve teaching effectiveness through detailed feedback.

Secondly, the post-class recall review method is an effective way to consolidate knowledge. Theoretical courses like exercise physiology are highly specialized and challenging, requiring timely review after class to effectively consolidate the effects of classroom teaching. As physical education students often have a heavy load of technical training and are frequently in a state of physical fatigue, it is recommended that they use the recall feedback method to review theoretical knowledge when resting or before going to sleep, trying to bring back the memory traces retained in the brain, deepening the impression and aiding memory and understanding. This is an active and effective learning method.

Thirdly, assignments and quizzes are also typical forms of feedback. Teachers can adjust the pace and content of their teaching based on the results of tests.

Fourthly, changing the traditional "cramming" teaching method to use heuristic teaching methods, making full use of visual aids such as diagrams, slides, and models to create a lively and dynamic teaching atmosphere, and mobilizing students' enthusiasm and initiative, can also be beneficial. Sometimes, designing classroom teaching in the sports field, such as testing some simple physiological indicators and observing physiological reactions after exercise, are all important feedback teaching methods.

## 4. Conditioned Reflex Formation and Extinction Theory in Teaching

The core tenet of connectionist learning theory is that learning is the process by which an organism forms associations between stimuli and responses under certain conditions, thereby gaining new experiences. This is the process of establishing conditioned reflexes, with representative figures including Thorndike, Pavlov, Watson, and Skinner, among others. A critical aspect of conditioned reflex formation

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is reinforcement; without reinforcement, there is no establishment or consolidation of conditioned reflexes. Students should fully consider the principle of conditioned reflexes in their theoretical studies. Reviewing after class is a form of reinforcement, and timely review is required. According to the memory patterns in physiology, forgetting occurs quickly at first and then slows down. Extensive research indicates that the most forgetting occurs within the first two to three days after memorization, and the forgetting time can gradually extend thereafter until long-term memory is formed. (Note: The sentence seems to be cut off and " forgetting time " is untranslated. I assume it should be something like "the period of forgetting can gradually extend thereafter until long-term memory is formed.") The new knowledge learned in class leaves a temporary memory trace in the brain, but this trace can quickly fade. Understanding the theories of reinforcement and extinction, as well as the patterns of memorization, will aid in the teaching of professional theoretical courses. Timely review after class or periodic review can help form a profound memory trace, and pre-class review, classroom questioning, and testing exercises all contribute to the reinforcement and consolidation of memory. Additionally, the arrangement of theoretical courses for a week should ideally be twice a week, with an interval of one to three days. Only by scientifically arranging the amount of knowledge information and intervals can knowledge mastery be facilitated.

## 5. Dynamic Equilibrium Theory in Teaching

The human body's internal environment is in a state of dynamic equilibrium, a stable balance. If this balance is disrupted, the body can become disordered, leading to dysfunction or disease. The theory of dynamic equilibrium, when applied to the teaching process, suggests that learning is a journey, not a destination. It implies that information should be fed to the brain in manageable portions, intermittently. The brain should be allowed to reach a state of equilibrium or saturation, then after a period of "digestion," new information can be introduced, continuously establishing new equilibrium points. Knowledge is not acquired all at once but is a process that requires gradual accumulation, transitioning from quantitative to qualitative changes, evolving from foundational to innovative knowledge. Physical education students often undergo greater physical exertion compared to students in other majors, which can lead to fatigue and low cortical excitability in theory classes. Traditional teaching methods that overload students with information in a single session or are dominated by the teacher (known as a "one-man show") are unlikely to be effective. According to the theory of dynamic equilibrium and the mechanisms of brain fatigue, the art of teaching should follow the principle of "small but frequent portions, flexible and diverse." This involves categorizing key points and addressing difficult topics one at a time, rather than merely rushing to complete the teaching plan, which would violate cognitive load theory. Therefore, in the classroom, it is advisable to employ methods such as discussion and heuristic teaching to create an atmosphere that alternates between relaxed and focused, thereby enhancing teaching effectiveness. This approach helps to maintain student engagement and facilitates better understanding and retention of knowledge.

## 6. The 'Hunger Theory' and Its Application to Teachin

The "sugar-loading" method used for large competitions and sports training actually applies the principle of supercompensation, which first involves consuming as much of the body's stored glycogen as possible to reach a state of "sugar starvation." The more thorough the consumption, the more pronounced the supercompensation. This principle can also be applied to guide the teaching process. Currently, many college courses have few class hours but a lot of content. For instance, the study of exercise physiology has been reduced from over a hundred hours to just a few dozen in many schools. Teachers often have to adopt the rote and traditional "cramming" method to complete the teaching tasks and keep up with the teaching schedule. Students passively receive information, and teachers present all the knowledge or results at once, causing students to become "overfull" and "lose appetite" from passive overconsumption, without the time or space for active learning or thinking, thus losing interest in theoretical study. The teacher's "full-class infusion" is a typical phenomenon of the separation of "teaching" and "learning," not paying attention to students' learning dynamics, and is a teaching method that lacks humanization. The "hunger theory" suggests that university teaching should adopt guided or heuristic teaching to raise questions, causing psychological changes in students during class, focusing their attention on the problems and the thinking

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process, with an emphasis on students' self-learning and active participation in discussions, always maintaining a "hungry" interest in knowledge, thereby stimulating students' desire to learn, that is, emphasizing the main position of students and the leading role of teachers.

## 7. The Functional Division and Interactive Inhibition Principle of the Cerebral Hemispheres in Teaching

The cerebral cortex has distinct functional localizations; for example, the intellectual areas are located in the frontal regions, and the motor areas are in the precentral gyrus. When the brain is working, there is an inhibitory relationship between the excited areas and the non-excited areas. Based on this principle, changing the method of work or the location of work is a form of active rest, especially switching between mental and physical labor, which can effectively promote the recovery from fatigue. However, for students majoring in physical education, the course load is heavy, and both physical and mental workloads are intense. Switching to physical exercise teaching after mental fatigue has good effects, but the reverse—switching to mental learning after physical fatigue—has very poor results. This contradiction poses a challenge to the teaching of theoretical courses in physical education majors. To address this issue from the perspective of fatigue recovery, the best solution is sleep; only by ensuring adequate sleep can the dual recovery of physical and mental fatigue be guaranteed. Therefore, a regular lifestyle and work-rest regime are the guarantees for physical and mental harmony and good teaching outcomes.

## 8. Conclusion

In summary, closely integrating the principles of exercise physiology with teaching, applying theory to practice, and continuously consolidating, enhancing, and expanding in practice, is an effective method of using knowledge itself to guide teaching. The teaching theories extended from the principles of exercise physiology emphasize the optimal state of cerebral cortex excitation, the importance of students' self-learning abilities, post-class recovery from physical and mental fatigue, and timely review and reinforcement of knowledge. They also emphasize the adoption of heuristic and discussion-based teaching methods by teachers, as well as the reasonable arrangement of teaching plans. Truly applying these theories to the classroom of exercise physiology or other theoretical classes will effectively improve the teaching effectiveness of theoretical courses in physical education, enhance students' learning capabilities, and the teaching abilities of instructors.

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