

# Research Status of Motor Quotient and Its Evaluation System

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**Abstract:** By combing relevant research on the development status of motor quotient and its evaluation system at home and abroad, this paper expounds and clarifies the future research direction of motor quotient as well as constructs a basic framework of motor quotient concept classification and evaluation-application system. Research found that first, the research on motor quotient abroad started earlier and has rich evaluation means, mainly focusing on the clinical diagnosis of preschool children's development and the evaluation of motor development, but there is little discussion on the concept of motor quotient, only involving the discussion on sports quality and kinesthetic intelligence; applied research is mainly reflected in the fields of physical education and medical clinic. Second, there are many discussions on the concept and connotation of motor quotient in China. The research on evaluation system is gradually enriched, but most of it is used in the field of education, while that of practical application is almost bare. Third, the future research direction should focus on teenagers, carry out research from a multi-disciplinary perspective, broaden the research field, and enrich practical application.

**Keywords:** Motor quotient; Evaluation; Research status

**Online publication:** February 17, 2022

## 1. Introduction

The results of the *Eighth National Students Physical and Health Survey* released by the Ministry of Education on September 3, 2021, showed that the "excellent rate" of teenagers' physical health reaching the standard has increased, and their physical qualities, such as flexibility, strength, speed, and endurance, have improved. *The Project to Strengthen the Physical Strength of Young People and Children* has clearly put forward that in order to promote the physical development of young people, it is necessary to strengthen the problem orientation, develop intelligent tests and evaluation, as well as strengthen the construction of data and standardization. In 2012, Professor Zongping Wang first proposed to "pay attention to motor quotient and improve students' sports potential," which attracted extensive attention from all walks of life. His research on motor quotient aimed to cultivate people's awareness of active exercise and lifelong sports habits, tap sports interest and sports potential, as well as truly promote an all-round and healthy development.

A clear and correct concept is the cornerstone of all thinking. The concept of motor quotient is the basis of dynamic quotient research, and a scientific and effective evaluation tool is an important condition for its research development. Practical application research is a further exploration of application approaches based on the research results of evaluation tools and is the key path for motor quotient to realize its research value from theory to practice. This paper carefully combs the research results, summarizes the gains and losses, defines the deficiencies, as well as provides valuable reference suggestions for future research from

three dimensions: research status, evaluation tools, and future development direction of motor quotient.

## **2. Research status of motor quotient**

### **2.1. Concept of motor quotient**

Purely from the perspective of scientific knowledge, the research on motor quotient abroad started far earlier than that in China. In foreign countries, the study of motor quotient is mainly reflected in the applied research of sports and clinical diagnosis of children's motor development. Although there is no clear conceptual definition of the word "motor quotient," it explains the connotation. The earliest dynamic quotient research in the field of sports appeared in McCloy's measurement research on general motor capacity to explain the total score of general motor capacity <sup>[1]</sup>. He believes that motor quotient is an index to measure the relative height, weight, and maturity of general motor capacity. In the research, "capacity" refers to people's innate sports potential, not just their ability; "motor" refers to neuromuscular and motor sensation; it does not refer to motor intelligence; "general" refers to the most basic athletic ability, and not specific skills. In the clinical field of children's motor development, "motor quotient" is used to reflect children's motor skill level. Here, "motor" means motor ability, which refers to children's movement, such as walking, running, jumping, sitting, climbing, and grasping; it does not refer to sports skills. For example, in 1985, Capute predicted children's motor retardation through the measurement of motor quotient <sup>[2]</sup>, and in 2010, Emck studied the overall motor ability of children with mental disorders <sup>[3]</sup>. Both expressed the development level of motor skills with motor quotient.

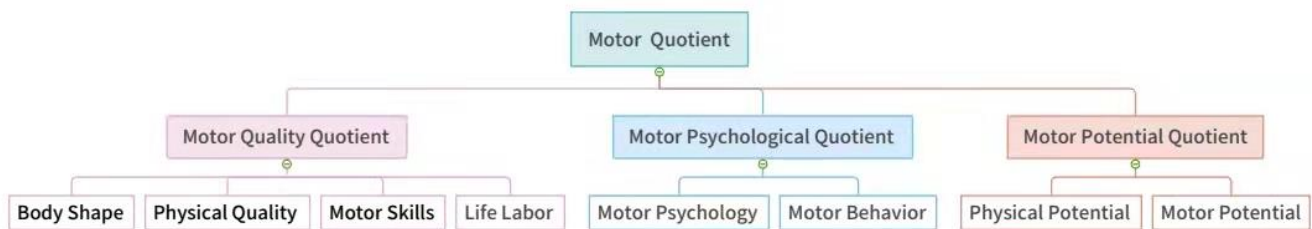
In China, "motor quotient," as an independent concept, was first proposed by Professor Zongping Wang in 2012. In 2014, the concept of motor quotient was defined. Motor quotient refers to the quotient of individual sports, the ability of individuals to overcome themselves and objective things, as well as the ability of people to tap and give full play to their sports talents and potential, mainly including their sports quality, sports psychology, physical function, etc. <sup>[4]</sup>. His concept is based on Gardner's multiple intelligence theory. Gardner believes that intelligence is an organic whole composed of various kinds of intelligence that are independent and equal to each other. Among them, body-kinesthetic intelligence mainly refers to the ability to use limbs and the body, which is manifested as better control of one's own body by exhibiting appropriate physical responses to events and expressing one's own emotions through body language <sup>[5]</sup>. Some scholars also expressed their views on the connotation of the concept of motor quotient. Lei Jiang believes that motor quotient is a quotient, which is used to tap sports talent, reflect sports potential, and reflect an individual's comprehensive sports energy, but it does not reflect an individual's competitive level <sup>[6]</sup>; Haixu Hu believes that motor quotient can reflect the comprehensive quality of individuals, including the control, expression, and association of an individual's physical and psychological functions along with the ability to establish coordination with the nervous system and to maintain the function of the central nervous system <sup>[7]</sup>.

To sum up, the cognition of scholars on the concept of motor quotient is consistent but different. The consistency is that they believe that motor quotient is a concept highly related to motor ability and represents motor ability itself; the difference is in the inclusion relationship of motor quotient among sports ability, sports quality, and sports intelligence. In consideration of previous studies, the author believes that motor quotient refers to the quotient value of individual sports ability, which reflects the level of an individual's comprehensive sports ability, mainly including sports quality, physical function, sports skills, sports psychology, and other elements. It is affected by genetic factors, but it can be transformed through acquired training.

## 2.2. Classification of motor quotient

No proprietary classification of motor quotient has been found abroad, but the expressions of gross motor quotient and fine motor quotient are found in most studies. Some domestic experts and scholars hold different opinions. First, based on the different types of muscle groups involved in completing motor skills, it is divided into gross motor quotient, fine motor quotient, and total motor quotient. This division limits motor quotient to motor skills and does not reflect the connotation of motor quotient. Secondly, based on the presentation of motor quotient, it is divided into explicit motor quotient (motor ability) and implicit motor quotient (motor potential). Thirdly, based on the development sequence of motor quotient, it is divided into child motor quotient, youth motor quotient, middle-aged motor quotient, and elderly motor quotient. This division only distinguishes in terms of age, but it is not operable in practical measurement and application. Fourth, based on the constituent elements of motor quotient, it can be divided into body quotient, behavior quotient, and task quotient. Although this classification can better reflect individual differences, the description of the connotation of dynamic quotient is too abstract.

In consideration of previous research results, drawing on the concepts of sports quality, sports skills, life and labor, as well as the measurement of IQ and EQ, the author believes that the classification of motor quotient should better reflect the constituent elements of the concept of motor quotient (**Figure 1**). Therefore, sports quotient should be divided into sports quality quotient, sports psychological quotient, and sports potential quotient. Sports quality quotient includes body shape, physical quality, sports skills, as well as life and labor; sports psychological quotient includes sports psychology and sports behavior; sports potential quotient includes physical potential and sports potential. This classification can fully reflect the connotation of the concept of motor quotient and contribute to the formulation of an evaluation scale as well as the development of theoretical and practical research.



**Figure 1.** Basic framework of motor quotient concept classification

## 2.3. Research on the function and value of motor quotient

There are several studies on the function and value of motor quotient abroad. John H. Jenny discussed motor quotient and intelligence quotient in 1959 [8]. He stated that motor quotient and IQ are equally important. There are relatively many theoretical discussions on the function and value of motor quotient in China. Zongping Wang believes that the functional value of motor quotient is to guide people to master and develop their own motor skills according to the objective law of human motor development, so as to establish lifelong sports consciousness, fully tap their potential, improve their sense of self-efficacy, encourage them to have lifelong sports ability, as well as promote physical and mental health. In competitive sports, the test and evaluation of motor quotient can also be used as an important reference for the selection of athletes, thereby it is worthy of in-depth exploration. Many domestic scholars have discussed the function and value of motor quotient in different fields, such as the function of fitness, the function of perfecting personality, the function of evaluation and measurement, the function of looking at history, and so on. In the field of internet, Hui Wang believes that in the “Internet +” era, motor quotient

can improve people's behavior of controlling the internet. It will become a new concept to change human's awareness of physical activity <sup>[9]</sup>.

### **3. Research status of the evaluation system of motor quotient**

#### **3.1. Measurement method**

In the field of physical education abroad, the measurement and research of students' general sports ability is mostly based on the following formula:  $MQ = 100 (\text{general motor capacity}) / \text{norm of classification index}$ . The results reflect the relative position of the development level of an individual's general sports ability in the population. The test index of this measurement is sports quality. Sports psychological quotient and sports potential quotient are not measured, so the measurement content is relatively narrow. In the field of children's motor development, the formula,  $MQ = \text{motor age} / \text{physical age}$ , is used to reflect children's motor development level. This calculation is affected by age. With gradual growth, the calculation results will become lower and lower. Therefore, this calculation is mostly suitable for the measurement of children's dynamic quotient.

Chinese scholars have made some achievements in the measurement methods, contents, and scale making, but there are deficiencies. Professor Zongping Wang and others developed the MQ-C scale (including physical function, sports quality, sports psychology, and sports intelligence) for children aged 5-6 years. Referring to the calculation method of differential IQ, the calculation formula of children's motor quotient ( $MQ = 100 + 15Z$ ,  $Z = (X - \bar{X}) / S$ ) is derived, in which 100 is the average, 15 is the standard deviation, Z represents the individual as the standard score, and S represents the standard deviation of group score <sup>[10]</sup>. Some scholars believe that the MQ-C scale emphasizes too much on the innate physical quality and does not reflect the acquired environment as well as learning and training factors. It has certain applicability, but it lacks universality. Jindong Chang constructed the theoretical model of "three actions and one energy ratio" youth's motor quotient [ $MQ = (\text{sports ability} + \text{sports experience} + \text{sports willingness}) / \text{physical function}$ ]. The greater the MQ score, the higher the motor quotient. The study has a deep understanding of the concept and connotation of motor quotient, but the significance reflected by the formula is not explained in detail, so there is a certain one-sidedness <sup>[11]</sup>.

#### **3.2. Measurement tools**

Some infant motor development evaluation scales have been developed in foreign studies, such as Gesell Development Scale (GDS, 1940), Alberta Infant Motor Scale (AIMS, 1994), Gross Motor Function Measure (GMFM, 1989), Gross Motor Function Classification System (GMFCS, 1997), Peabody Developmental Motor Scales (PDMS), etc. In China, the production of motor quotient scale started late. The PGMQ scale, proposed by scholars in China Taiwan, is used for the evaluation of gross motor skills of children aged 3-6 years; the MQ-C scale, developed by Zongping Wang, is used for children aged 5-6 years; the motor consultation table for children aged 7-12 years and the follow up research of MQ-C scale for children aged 5-6 years have been compiled by Hongbing Zhang <sup>[12]</sup>. He divided the scale into three parts (including body quotient, behavior quotient, and task quotient). Task quotient involves the evaluation of children's fine movements; however, there is no clear standard for the measurement of behavior quotient. Most of these scales are used in the field of education.

#### **3.3. Practical application**

There are relatively many application systems of motor quotient abroad, mostly in the fields of physical education and medical clinic. In the field of physical education, Fransen found that the motor quotient of boys aged 6-12 years who participated in more than one sport was higher than that of boys who participated

in only one sport [13]. In the field of clinical medicine, studies have found that exercise intervention has significant effect on improving the motor quotient of children with early heart disease and developmental delay in the weak motor quotient group. Besides, it has been found that a mother's IQ is related to the motor quotient of her children's fine movement [14]. There are only a number of studies on the practical application of motor quotient in China, mostly in the field of physical education and mainly from the theoretical discussion of promoting sports skill learning and the formation of core literacy.

#### 4. Future development direction of motor quotient

The research on motor quotient should not be limited to the field of sports, but rather carried out from a multidisciplinary perspective. Its research field should be broadened, and the content of applied research should be enriched. Motor quotient should establish extensive contacts with many disciplines, such as kinematics, sports, psychology, physiology, medicine, history, sociology, and so on. It is necessary to strengthen the practical exploration of the application of motor quotient in various fields of sports, assume the advantages of foreign excellent motor quotient evaluation-application system, consider the promotion of physical health of teenagers and children as the research focus, strengthen the role of motor quotient in the formation of their sports skills, form a motor quotient culture with "motion" as the theme, as well as promote a healthy development of human physique.

In line with the current situation and future development direction of research on motor quotient at home and abroad, in order to realize the scientific research of motor quotient evaluation-application system, it is necessary to specifically construct a basic framework of motor quotient evaluation-application system, which is conducive to scholars to accurately grasp the research direction, so as to carry out more specific and targeted research on motor quotient. On the basis of previous studies, a basic framework of motor quotient evaluation-application system is constructed, hoping to provide reference for further research on motor quotient (Figure 2).

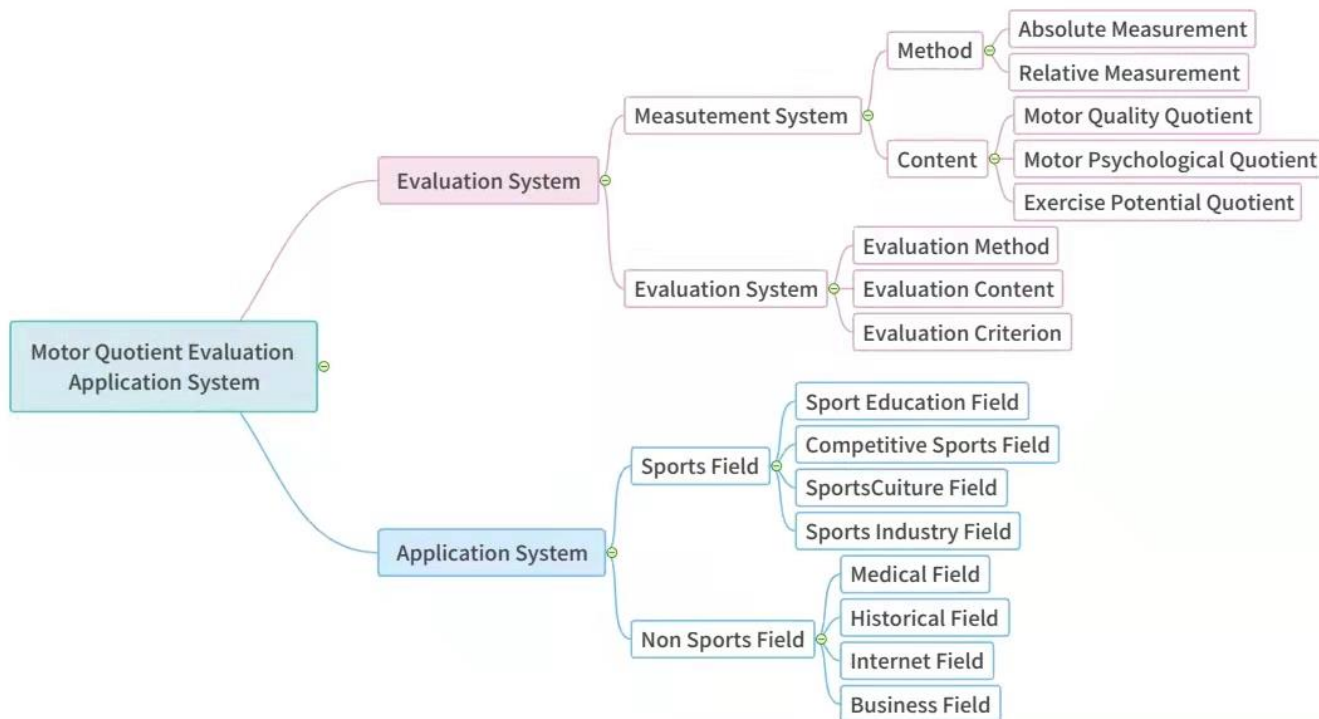


Figure 2. Basic framework of motor quotient evaluation-application system

## 5. Conclusion

In conclusion, foreign research on motor quotient started earlier, which was mainly reflected in the applied research of sports and the clinical diagnosis of children's motor development. There are many studies on the evaluation system of motor quotient, but there is no clear definition and classification of the concept of motor quotient, with little research on its function and value. Domestic research on motor quotient started relatively late. It defined the concept of motor quotient, described the connotation of motor quotient through a variety of classification methods, as well as interpreted the function and value of motor quotient in different fields. However, although some achievements have been made in the evaluation system of motor quotient, it is still in the initial exploration stage. There are resonance, differences, inheritance, and development between the two. In future research on dynamic quotient, we should take theory as the research basis, evaluation tools as the research means, and multi-scene practical application as the goal, founded on the integration of multi-disciplinary theories to promote the development of human health and physique.

## Disclosure statement

The authors declare no conflict of interest.

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