

The Professional Ability Evaluation Indicators and The Building of Evaluation System for Chinese Tennis Coaches

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Abstract

Using literature, expert interviews and questionnaire methods, the operational capacity of our tennis coaches indicators research, concluded that the operational capacity of indicators include Tennis Coach: Coaches character index, coaches, and coaches handling capacity indicators, performance indicators three-level index, and derived two, three indicators, which build the operational capacity of evaluation index system of coaches, tennis coaches finally come to an integrated score coefficient.

Keyword: Tennis Coach Operational capacity Evaluation Index Evaluation System

Nick Bollettieri, American famous tennis coach, came to China for communicating and said: "China are not lack of good players, just lacking of good coaches to train them to be world champions." These words make people can not help to ask our coaches team. What would happen to our domestic coaches' professional ability? Whether they actually have the ability to cultivate our own world champions or not? According to the existing research achievement in tennis, there is not a single piece to research the professional ability of coaches yet while most of the researches just focus on the technology and physical characteristics of players. For tennis coaches, we urgently need a evaluation system for coaches' professional ability to evaluate the indicators of coaches' professional ability scientifically and objectively. On the basis of the evaluation system, we can choose more excellent coaches to serve Chinese tennis sports. This will have huge significance for improving Chinese tennis players' ability to a high level.

1 The Research Object and Methods

College tennis teacher, tennis coach of provincial (city) level professional teams and amateur tennis coach who have tennis coaching experience.

After a review of relevant literature, from which, 3 primary indicators, 13 secondary indicators and 47 tertiary indicators were extracted to evaluate tennis coaches's professional ability.

Domestic tennis coach of professional team (provincial and city level professional teams), amateur tennis coaches and senior tennis teachers (professors, associate professors and academic leaders) were interviewed by face-to-face and telephone.

30 survey questionnaires were distributed to domestic tennis coaches of professional tennis (provincial and city level professional teams), amateur tennis coaches and senior tennis teachers (professors, associate professors and academic leaders). 25 questionnaires questionnaires were returned. The effective rate of questionnaires is 100%.

The analytic hierarchy process (AHP), developed by American mathematician A.L.Seaty in the 1970s, is a particularly suitable multi-objective decision analysis technology for complex hierarchy structure. It is a multi-objective decision and evaluation method combined with qualitative analysis and quantitative analysis.

2 Results and Analysis

The evaluation indicators for coaches' professional ability should have scientific connotation, because it closely relate to coaches' career and athletes' sports performance, health and career. Since that, we should take more consideration for athletes in the process of choosing evaluation system. The accurate, easily evaluated, reliable evaluation indicator system, which can be adapted to training practice, should be chose to reflect the coaches' professional ability scientifically and objectively.

In the process of choosing evaluation indicators, the accessibility, effectiveness and impartiality of indicators material should be fully considered. The subjective evaluation indicators should be quantifiable. The indicators which are difficult to quantify should take qualitative descriptions. In a word, the overall indicators system should keep the maximization of operability to truly reflect the problems which covered by indicators.

The indicators system should be designed with longitudinal comparability and transverse comparability to ensure the rationality, impartiality and objectivity of evaluation. Since some indicators are subjective evaluation of experts while some indicators are quantifiable indicators, the design of indicators system should consider not only quantifiable factor but also subjective ambiguity. They should be handled with layered, hierarchical distinction.

The coaches' professional ability is composed of a complex dynamic system. When we choose and define specific indicators to build a system of indicators, its

integrity, dynamic and systematic should be overall consideration. The indicators should also be considered with comprehensiveness of information and simplicity of indicators evaluation to avoid the interference by multicollinearity and serial correlation.

The coaches professional ability evaluation system should be as quantifiable as possible. However, for those important indicators which are hard to quantify, we can describe them with qualitative indicators or change the qualitative indicators into quantitative ones to make qualitative indicators more specific and objective.

The evaluation indicators system for coaches' professional ability should be able to describe and reflect the coaching level of coaches in certain period, besides, it also need to distinguish different coaching levels between coaches who have various ranks.

The evaluation indicators system for coaches' professional ability should be able to describe and reflect the changing trends of coaches' building their professional ability to provide the theoretical basis for training athletes, hiring coaches, and rating.

The evaluation indicators system for coaches' professional ability should be able to compare different inspection objects at the same time point. This comparison can help to recognize the comprehensive ability of inspection object. The system should also be able to compare the ability situation of same inspection object in different periods. This comparison can help to recognize the conditions and development trends of inspection object.

The coaches' professional ability structure is a complex system, which includes a number of interrelated but relatively independent different subsystems. Thus, according to the guiding design ideology, the basic selecting principles and the function of coaches' professional ability evaluation indicators system, we choose 3 primary indicators (including coaches' moral qualities, ability, diligence and accomplishment), 13 secondary indicators and 47 tertiary indicators to form evaluation indicators system (refer to table 1).

The moral quality reflects coaches' moral ideological and internal self-cultivation which can impact athletes directly. The performance of athletes in competition field can also indirectly reflect the level of coaches' moral ideological, particularly the reflection of coaches' professional moral quality. Therefore, the moral quality is one of the coaches' professional ability performances.

Coaches' ability indicators include 5 basic ability indicators, such as personal experience, material selection ability, train organizing ability, management ability, innovation ability and the ability to command the game. These 5 basic indicators play conclusive role in coaches' daily teaching. Therefore, these indicators play a key role in the process of evaluating coaches' professional ability.

"The best way to evaluate the teaching level of a coach is to look over what accomplishment his child had achieved" Taicixieer, the USTA coach in California Carson area, said. What if the coaches' ability indicator is an evaluation

for the coach teaching process, diligence and accomplishment indicator is an evaluation for coaches teaching outcome.

In order to ensure the accuracy, objective and scientificity of the study, also to avoid too much subjective element during the evaluation process, AHP will be primarily used to formulate the weight coefficients.

The main feature of AHP is to decompose a complex problem into multiple comprised elements. Being further decompose by dominance relations, these elements are arranged according to the target layer, criterion layer and indicators layer to form a multi-objective, multi-level model which forms a sequential and hierarchical hierarchy structure. To get the weight coefficients that comparing the importance between basic indicators and overall, comprehensive evaluation indicators, we need to judge and score by comparing the importance degree with each other layer by layer, by calculating the eigenvectors of judgment matrix to obtain the rate of contribution that lower level indicators contribute to upper level indicators. Of course, for decision makers, AHP can make the decision-making process, in which decision makers or evaluators make decisions and evaluation on complex issues, mathematical, modeling and objective. This method can not only simplify the calculation of system analysis but also help decision makers maintain the consistency of their thinking process. Thus, the process of hierarchical operation of AHP match the system intention including integrality, comprehensiveness, optimization and convenient. This method can be used to describe the indicators with both qualitative and quantitative.

Formulate Judgment matrix: evaluation objectives assumed as A, evaluation indicators set $B = \{a_1, a_2, \dots, a_n\}$, formulate judgment matrix $F(A-B)$ as follows:

$$F = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix}$$

The a_{ij} element in judgment matrix F represents the relative importance of the value factors ($i = 1, 2, \dots, n ; j = 1, 2, \dots, n$), the judgment scale and definition of a_{ij} (refer to table 2).

Table 2 Judgment Scale and Definition Table

Judgment Scale (The value of a_{ij})	Definition
1	a_i is as important as a_j
3	a_i is more important than a_j slightly
5	a_i is more important than a_j
7	a_i is much more important than a_j
9	a_i is more important than a_j absolutely
2, 4, 6, 8	respectively between 1-3, 3-5, 5-7, 7-9
$a_{ij} = 1 / a_{ji}$	indicates the less important degree of j to i

Take the evaluate indicators of Chinese tennis coaches' professional ability as overall objective (A). Comparing with the overall objective, the importance degree between 3 primary indicators (B) is consulted from expert questionnaires

survey. Then, after these data is transferred into data matrix, we can get the hierarchy judgment matrix A→B. (refer to table 3)

Table 3 List of Coaches' Professional Ability Evaluation Matrix

A	B1	B2	B3
B1	1	a	b
B2	1/a	1	c
B3	1/b	1/c	1

As shown in Table 3: B1 indicates coaches' moral qualities, B2 indicates coaches' professional ability, B3 indicates coaches' diligence and accomplishment quality. In table 3, a, b, c indicate the value of relative importance based on expert judgment resulting data table. By calculating the judgment matrix, we can get the matrix feature vector $W = \{W_1^0, W_2^0, W_3^0\}$, that is, the weight values of evaluation elements B1, B2, B3 are respectively W_1^0, W_2^0, W_3^0 . The process of specific operation is as follows.

Firstly, when we analysis the multi-objective with AHP, we need to know the relative importance of ai to A, that is, the relative weight coefficients of ai to A. To do this, you can calculate the eigenvector of relevant judgment matrix, W. Then, you can calculate the relative importance of ai to A, that is weight. Thus, the method of calculating the component Mi of eigenvectors W as follows:

$$(1) M_i = \prod_{j=1}^n a_{ij} \quad (i = 1, 2, \dots, n)$$

(2) Calculate the n equation root \bar{W}_i of M_i , according to the formula $\bar{W}_i = \sqrt[n]{M_i}$, Calculation results: $\bar{W}_i = \{\bar{W}_1, \bar{W}_2, \dots, \bar{W}_n\}$

(3) Normalized process $\bar{W} = \{\bar{W}_1, \bar{W}_2, \dots, \bar{W}_n\}^T$, according to the formula

$$W_i^0 = \frac{\bar{W}_i}{\sum_{i=1}^n \bar{W}_i}, \text{ separately calculate } W_i^0, \text{ then calculate } W_n = \{W_1^0, W_2^0, W_n^0\}.$$

(4) Calculate the max characteristic root λ_{\max}

$$\ln \lambda_{\max} = \sum_{i=1}^n \frac{(AW)_i}{nW_i^0}, \quad (AW)_i \text{ represents the } i\text{-th element of the vector } AW.$$

(5) Consistency Test

Assume the largest eigenvalue of above matrix as λ_{\max} , then test the eigenvector W. Firstly, the formula to calculate the Consistency Index CI is as follows:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (1)$$

n is the betweenness of judgement matrix A.

Then, find the value of average random index RI in table 4.

Table 4 The Index Value List of Random Index in AHP

M	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.14	1.45	1.49

Each data in Table 4 is the average random index which is the result of calculating the positive and negative matrix more than 1000 times.

Finally, calculate the consistency ratio (CR), formula is as follows: $CR = CI / RI$. When $CR < 0.1$, that the judgment matrix meets the consistency, that is, the component of the eigenvector W can be the weight; If $CR \geq 0.1$, which means that the judgement matrix does not pass the test, the component in eigenvector W can not be the weight. Instead, the judgment matrix should be corrected until meets the consistency. In the same way, we can obtain the weight coefficient of sub-level indicators and all individual indicators, and finally, obtain the weight value of all levels indicators.

2.5 The Standardization Process of Evaluation Indicators

For comparison, we use dimensionless method, which is standardization process, to deal with each evaluation indicators based on the function and the form of each factor, sub-factors. The method is as follows:

Step one: For most quantitative indicators, when the indicator is positive indicator, when the index value is greater, more favorable to improving the professional ability of tennis coaches. The formula is as follows:

$$\chi = \frac{c}{c_0} \quad (2)$$

When the indicator is negative indicator (when the index value is smaller, more favorable to improving the professional ability of tennis coaches). The formula is as follows:

$$\chi = \frac{1}{c \cdot c_0} \quad (3)$$

Wherein χ is the weight value of single indicator, c is the actual value for a particular indicator; c_0 is the standard value for indicator evaluation.

Step Two: To standardize other measurable moderate indicators (The indicators which value should be neither too large nor too small), such as the number of individual awards, the number of team members and academic papers etc. Since it have a moderate point in indicators change range, moderate indicators can be taken as a combination of positive indicators and negative indicators. Within a certain range, before the indicator value reaches the moderate point, it is a positive indicator; but after the indicator value reaches the moderate point, it is a negative indicator. That is to say, for moderate indicators,

assume K as the moderate value of moderate indicators, use positive indicator formula when $C < K$; use negative indicator formula when $C > K$.

3 Conclusion

Since each indicator in tennis coaches' professional ability indicators evaluation system reflects the coaches' teaching ability from different angles, we still need comprehensive evaluation to fully reflect the coaches' professional ability. In this paper, multi-objective linear weighted method will be used to evaluate tennis coaches professional ability comprehensively. The function expression is:

$$Z = \sum_{i=1}^m \left[\sum_{j=1}^n \left(\sum_{K=1}^I I_k \cdot R_k \right) \cdot U_j \right] \cdot w_i \quad (4)$$

Wherein Z is a comprehensive score, I_k is the score of single indicator; R_k is the weight value for the single indicator at the right level, U_j is the weight value of sub-indicator; W_i is the weight value of primary indicators. Therefore, the comprehensive evaluation criteria is as shown in Table 6.

Table 6 The Evaluation Criteria of Tennis Coaches' Professional Ability

Comprehensive evaluation value Z (%)	<50	50 ~ 70	70 ~ 90	> 90
Evaluation Criteria (Tennis Coach professional ability stage)	experience	experience	experience	experience
maturity		accumulation	growth	abundance
rich mature growth				

We can know the coach level of tennis coaches' professional ability from table 6. When the comprehensive evaluation value (Z) is less than (<) 50%, the level of tennis coaches professional ability is in accumulation stage; when the comprehensive evaluation value is greater than (>) 50% less than (<) 70% the level of tennis coaches professional ability is in a growth stage; when the comprehensive evaluation value (Z) is greater than (>) 70% less than (<) 90%, the level of tennis coaches professional ability is a abundance stage; when the comprehensive evaluation value (Z) is greater than (>) 90% the level of tennis coaches professional ability is in maturity stage. By this criteria, the tennis coaches operational capacity status of a preliminary understanding, in order to provide a reference for our tennis coaches rating and assessment.

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