

The construction of evaluation system for the business ability of social sports instructors

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Abstract: *Literature, expert interviews and questionnaires were used to study the index system of social sports instructors' business competence. Indicators of the operational capacity of social sports instructors have been constructed, which include four first-level indicators of social sports instructors' professionalism, professional competence, judging competence and career development competence, as well as nine second-level indicators and 26 third-level indicators. The construction of this evaluation index system solves, to a greater extent, the many difficulties in the evaluation of the business ability of social sports instructors.*

Keywords: *Social sports instructor; Operational competence; Evaluation indicators; Evaluation system*

1. Introduction

The 19th National Congress has made major decisions and deployments for the implementation of the Healthy China Strategy, and in the Action for a Healthy China (2019-2030), it is proposed that, in order to actively deal with the current outstanding health problems, it is necessary to move the goalposts forward, take effective interventions, and endeavor to make the public less sick, less sick, improve the quality of life, and prolong the healthy life expectancy. In the national fitness campaign, it is advocated that social sports instructors should be encouraged to provide scientific guidance services to the public in fitness venues and other places to improve fitness results and prevent sports injuries; this fully reflects the firm determination of the Party and the State to safeguard the health of the people. Therefore, it is particularly important to develop an effective method to scientifically evaluate the professional ability of social sports instructors^[1]. This paper conducts an in-depth study on the construction of evaluation indexes and systems of social sports instructors' business ability, aiming to provide reference for related research.

2. Research methodology

2.1 Literature method

Through reviewing relevant literature, from which 4 first-level indicators, 9 second-level indicators and 26 third-level indicators for evaluating the business ability of social sports instructors were extracted.

2.2 Expert Interview Method

National social sports instructors, amateur social sports instructors and quite experienced physical education teachers were interviewed through talks and interviews.

2.3 Questionnaire method

A total of 160 questionnaires were distributed to national social sports instructors, amateur social sports instructors and quite experienced physical education teachers, 160 questionnaires were recovered, and 160 questionnaires were valid, with a valid recovery rate of 100%.

2.4 Hierarchical analysis

Hierarchical analysis (AHP) is a decision-making method for qualitative and quantitative analysis^[2].

3. Results and Analysis

3.1 Principles of Indicator Design

3.1.1 Scientific principle

The indicators for evaluating the business ability of social sports instructors should have scientific connotation, because it is closely related to the instructor's profession and the instructed sports performance, physical health and career, and in the process of selecting the evaluation indicators, we should stand in the perspective of the instructed personnel to give more consideration^[3,4], and we should select the evaluation indicator system which has accurate meaning, is easy to be evaluated, is reliable, and can be compatible with the training practice, and which is scientific and objective reflect the coach's work ability.

3.1.2 Principle of operability

When selecting evaluation indicators, we must consider the accessibility and timeliness of the indicators, design quantifiable evaluation indicators, and according to the situation, some of the indicators can be described qualitatively, so as to ensure the operability of the whole indicator system as far as possible.

3.1.3 Principle of comparability

The vertical and horizontal comparability of indicators must be considered when designing indicators to ensure the objectivity and fairness of the evaluation. Since some indicators are subjective evaluations by experts, others are quantifiable indicators. Therefore, the design must take into account quantitative factors, while also recognizing subjective ambiguity, and should be treated differently in a hierarchical and graded manner^[5].

3.2 Functions of the indicator system

3.2.1 Reflective function

The evaluation index system of the business ability of social sports instructors should be able to describe and reflect the teaching level of a social sports instructor at a certain time, and also reflect the different distinctions between different levels of social sports instructors.

3.2.2 Comparative function

The index system must be able to truly reflect the level of business ability of social sports instructors, and provide theoretical basis for training, social sports instructor hiring and rating.

3.3 Indicator system construction

A total of 160 national social sports instructors, amateur social sports instructors and professionals were researched through an in-depth study of seven renowned experts, followed by an online questionnaire. It was finally decided to select 4 first-level indicators of social sports instructors' professional quality, professional competence, judging ability and career development, and 9 second-level indicators with a total of 26 third-level indicators as the evaluation index system of social sports instructors' competence (Table 1).

Table 1: Indicator system for capacity evaluation

Level 1 indicators	B	Level 2 indicators	C	Level 3 indicators	D (weight value)
Professionalism	B1	Quality of thought	C11	Ideology and morality	D111
				Behavior	D112
		Professional ethics	C12	Industrious and hard-working	D121
				Devotion	D122
Professional capacity	B2	Learning experience	C21	Self-control	D211
				Academic structure	D212

				Professional experience	D213
				Competition result	D221
		Coaching capacity	C22	Fundamentals of Sports Theory	D222
				System of sports regulations	D223
				Fitness Program Development	D224
				Lecture and Demonstration	D225
				Exercises and summaries	D226
		Coordination capacity	C23	Identifying and solving problems	D231
				Team Collaboration	D232
				Social intercourse	D233
Ability judge	B3	Assessment capacity	C31	Managing affairs	D234
				Physical assessment	D311
		Adaptability	C32	Fatigue and Injury Assessment	D312
				Incident management	D321
				Injury and illness management	D322
Career development capacity	B4	Research capacity	C41	Transformation of results	D411
				Sort	D412
		Learning ability	C42	Continuing education	D421
				Innovations in work	D422
					(0.0305)
					1.000

3.4 Determination of indicator weights

3.4.1 Determination methodology

The Delphi method is used to consult the experts and let them rate the importance of each indicator, and then judge the rating by comparing the degree of importance with each other layer by layer, using the calculation of the eigenvectors of the judgment matrix to determine the degree of contribution of the next level of indicators to the previous level of indicators^[6], so as to get the weights of the grass-roots level of indicators to the overall goal or the importance of the comprehensive evaluation of indicators, so as to ensure the scientific and objectivity of the indicator system^[7].

Step 1: Expert scoring. The questionnaire was designed in strict accordance with the principles of the Delphi method and consisted of 4 sections.(1) Introduction of the purpose and significance of the study and instructions for completion to the expert. (2) Basic information about the expert (area of specialization, years of teaching experience, education, and title).(3) The main body of the questionnaire is compiled according to the index system of social sports instructor's business ability, and experts rate the importance of indicators at all levels, using a 5-level scale method, from “not important” to “very important” according to the scoring from 1 to 5, with the higher the score indicating the higher the degree of importance. The higher the score, the higher the degree of importance, and suggestions for deletion, modification, addition or deletion are made for each indicator. (4) Self-assessment of the degree of authority of experts, mainly including the basis of judgment and the degree of familiarity.

Step 2: Hierarchical analysis. The main feature of the hierarchical analysis method is to decompose the complex problem into multiple constituent elements and further decompose these elements according to the dominant relationship, arranging them according to the target level, criterion level and indicator level to form a multi-objective, multi-level model, forming an orderly, stepwise hierarchical structure.This process is in line with the systematic idea of holistic, integrated, optimal and simple, and the indicators are described both qualitatively and quantitatively.

3.4.2 Main steps

Step 1: Research and development of questionnaire distribution experts to determine the level of importance of the indicators.Step 2: Design judgment matrix. Set the evaluation indicator as A, the set of evaluation indicators as B = { a1 , a2 , a3 ... an}, and the judgment matrix F (A-B) :

$$F = \begin{pmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn} \end{pmatrix}$$

Note: The element a_{ij} in F denotes the relative importance value of the factor ($i = 1,2,3,\dots, n ; j = 1,2,3,\dots, n$), the judgment scale and meaning of a_{ij} (Table 2).

Table 2: Table of judgment scales and meanings

aij value	Meaning
1	a _i and a _j as important as b c
3	a _i is slightly more important than a _j
5	a _i is more important than a _j
7	a _i is significantly more important than a _j a/c b/c
9	a _i is significantly more important than a _j 1
2,4,6,8	Between 1-3, 3-5, 5-7, 7-9, respectively
a _{ij} =1/a _{ji}	Indicates the degree to which j is less important than i

Step 3: Calculate the judgment matrix. By setting the evaluation system of social sports instructors' business competence as the overall objective (A), comparing the importance of the four first-level indicators (B), soliciting experts on the importance of each evaluation indicator and transforming it into a data matrix, a hierarchical judgment matrix of A → B was derived (Table 3).

Table 3: List of evaluation matrices

A	B1	B2	B3	B4
B1	1	a	b	c
B2	1/a	1	b/a	c/a
B3	1/b	a/b	1	c/b
B4	1/c	a/c	b/c	1

As shown in Table 3, where B1 indicates professional qualities, B2 indicates professional competence, B3 indicates judging competence, B4 indicates professional development competence. In Table 3, a, b, and c denote the relative importance scores obtained according to the expert judgment data table. By calculating the above judgment matrix, the eigenvector of the matrix $W = \{W, W, W, \}$, i.e., the weight values of the evaluation factors B1, B2, and B3 are W, W, W, respectively, and the procedure is as follows.

Knowing the relative importance of a_i for A, i.e., the weight of a_i, using the hierarchical analysis method, the relative importance of a_i for A, i.e., the weight coefficient, can be found by first calculating the eigenvector W of the judgment matrix concerned. The method of calculating the component M_i of the eigenvector W is as follows:

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

(2) Calculate the root i of the nth equation of M_i according to the formula $i = \sqrt[n]{M_i}$, which is calculated as: $i = \{1, 2, \dots, n\}$

(3) The feature vector $W_n = \{W, W, W\}$ can be derived by normalizing $= \{1, 2, \dots, n\}^T$ and calculating W according to the formula $W = \frac{M_i}{\sum_{i=1}^n M_i}$.

(4) Calculate the largest characteristic root of the judgment matrix λ_{max}

In $\lambda_{max} = \frac{1}{n} \sum_{i=1}^n (A W)_i$ denotes the ith element of the vector A W .

(5) Consistency test of judgment matrix.

The maximum characteristic root of the above matrix is set to λ_{max} then the test of the eigenvector W is carried out. First calculate the consistency index CI (Consistency Index) calculated as:

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{1}$$

Note: n is the order of the judgment matrix A. Then find the corresponding average stochastic consistency indicator RI values according to Table 4.

Table 4: List of stochastic consistency indicator values

M	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.000	0.53	0.89	1.22	1.14	1.32	1.24	1.35	1.39

Note: Each figure in Table 4 is the average random consistency index obtained by computing the positive and negative matrices more than 1000 times.

Finally, the consistency ratio CR (Consistency Ratio) is calculated as $CR = CI/RI$. When $CR < 0.1$, it is considered that the judgment matrix satisfies consistency, that is, the components in the eigenvector W can be used as the weights; if $CR \geq 0.1$, it is considered that the judgment matrix does not pass the test, and the components in the vector W can not be used as the weights, and should be corrected to the judgment matrix until it satisfies consistency. The judgment matrix should be corrected until the consistency is satisfied. By analogy, the weight coefficients of indicators at all levels and other single indicators can be calculated, and the weight values of indicators at all levels are shown in Table 5.

Table 5: Hierarchical ranking of evaluation indicators

Indicator B layer weight value $\sum w$ 1.000					
Indicator C layer (weight value)	B1 0.2018	B2 0.4345	B3 0.1955	B4 0.1682	Indicator D layer (weight value)
C11 (0.0904)					D111(0.0482)
					D112(0.0422)
C12(0.1114)					D121(0.0523)
					D122(0.0257)
C21(0.0663)					D211(0.0081)
					D212(0.0264)
					D213(0.0318)
C22(0.2845)					D221(0.0190)
					D222(0.0209)
					D223(0.0236)
					D224(0.0909)
					D225(0.1109)
					D226(0.0192)
C23(0.0837)					D231(0.0287)
					D232(0.0271)
					D233(0.0180)
					D234(0.0099)
C31(0.0964)					D311(0.0426)
					D312(0.0538)
C32(0.0991)					D321(0.0553)
					D322(0.0438)
C41(0.0845)					D411(0.0327)
					D412(0.0518)
C42(0.0837)					D421(0.0532)
					D422(0.0305)
$\sum w$ (1.000)					1.000

3.4.3 Description of indicator weights

Among the B-level indicators, the weight coefficient of professional ability of social sports instructors is 0.4345, which is significantly higher than the other three B-level indicators, indicating that professional ability is the most core ability of social sports instructors; the weight coefficient of professional quality is 0.2018 ranking second, indicating that the professionalism and moral quality of social sports instructors are also more important, which is one of the important bases for judging their business ability; the ability to make judgments 0.1955 and career development ability 0.1682 ranked 3rd and 4th respectively, and social sports instructors' judgmental thinking ability and career development ability are important factors to improve their comprehensive ability. Among the C-level indicators, the weight coefficient of the social sports instructor's instructing ability of 0.2845 is significantly higher than other indicators of the same level, and the weight coefficients of its subordinate D-level indicators of explaining and demonstrating, practicing and summarizing are

similarly higher than other indicators of the same level, which indicates that the ability of instructing and training is the most important among all the abilities of the social sports instructors^[8].

3.5 Standardization of indicators

In order to facilitate comparisons, the following methodology was adopted to standardize the evaluation indicators in a dimensionless manner, i.e., according to the nature of the roles and manifestations of the factors, sub-level factors and factors^[9].

Step 1: For most of the quantitative indicators, when the indicator is positive, i.e., when the larger the value of the index is, it is more favorable to the improvement of the business capacity of social sports instructors, which is calculated by the formula:

$$\chi = \frac{c}{c_0} \tag{2}$$

When the index is negative (i.e., when the smaller the value of the index, the more favorable to the improvement of the coaching ability of social sports instructors), the formula is:

$$\chi = \frac{1}{c \cdot c_0} \tag{3}$$

Note: The formula is the weight value of a single indicator, c is the actual value of an indicator; c₀ is the standard value of the evaluation of the indicator.

Step 2: In addition to the standardization of measurable indicators of moderation other than (1), such as the number of individual awards, the number of team leaders, the number of academic papers and other indicators of moderation (i.e., the value of the indicator should not be too large, nor should it be too small), it should be within the range of the indicator of the change of a moderate point, and therefore it can be regarded as a combination of positive indicators and negative indicators. In a certain interval, before the indicator value reaches the moderate point, it is a positive indicator; after the indicator value reaches the moderate point, it is a negative indicator. That is to say, for the moderate indicator, set K as the moderate value of the moderate indicator, when C < K, use the positive indicator formula; when C > K, use the negative indicator formula.

3.6 Evaluation Criteria

The evaluation index system of social sports instructor's business ability embodies various business abilities as well as key abilities required by social sports instructors from different dimensions, on the basis of which this study adopts the multi-objective linear weighting method to comprehensively evaluate the business ability of social sports instructors, and its functional expression is:

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

Note: In the formula Z is the value of the comprehensive score, I_k is the score value of a single indicator; R_k is the weight value of the single indicator under the level, U_j is the weight value of the sub-level indicator; W_i is the weight value of the first-level indicator. Therefore, the comprehensive judging criteria are shown in Table 6.

Table 6: Criteria for judging competence

Consolidated assessed value Z (%)	<50	50~70	70~90	>90
1				
2				
3				
Judge 0.00 0.000 0.53	Experience	Experience	Experience	Experience
Standard	Cumulative	Increases	Enrichment	Maturation

As can be seen from Table 6, the size of the comprehensive evaluation value of social sports

instructors represents the level of business ability. When the comprehensive evaluation value is less than 50%, it means that the business ability level of social sports instructors is in the stage of experience accumulation; when the comprehensive evaluation value is more than 50% and less than 70%, their business ability level is in the stage of growth; when the comprehensive evaluation value is more than 70% and less than 90%, it means that their business ability level is in the stage of abundance; when the comprehensive evaluation value is more than 90%, it means that the business ability level is in the maturity stage. The construction of this judging standard solves, to a larger extent, many difficulties in the evaluation of the business ability of social sports instructors, and provides a reference basis for the qualification certification, promotion and assessment of social sports instructors.

4. Conclusion

In his study, we constructed the evaluation index system of social sports instructors' business competence from four first-level indicators of professionalism, professional competence, judging competence, and career development competence, as well as nine second-level indicators and 26 third-level indicators, and finally came up with the comprehensive scoring standard for social sports instructors. The evaluation index system of this evaluation is constructed to solve the many difficulties in the evaluation of the business ability of social sports instructors to a larger extent.

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