

Research on Evaluation Index System of Physical Education Teachers in Middle School

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Abstract. On the basis of combining characteristics and actual development status of physical education, the paper makes an objective and scientific research on evaluation index system of middle school physical education teachers by using research methods of document research, questionnaire survey, interview and AHP analysis, in order to improve the quality of physical education and deepen the comprehensive reform of education. The results show that, the evaluation index system of middle school PE teachers should include four first grade indicators include routine work, professional accomplishment, professional ability and professional development, and twelve second grade indicators include teaching, class management, education research, teaching attitude, occupation ethics, communication skills, professional skills, training improvement, competition results, teaching research, professional development and professional innovation.

Research Objectives

China's new basic education reform specifically requires that, an evaluation system should be established to promote the development of students, teachers and curriculum; the development of basic education on the basis of evaluation system should also be promoted. [1] Teacher evaluation is an important and indispensable part of education evaluation. Through scientific measurement of the overall situation of teachers, their teaching performances can be shown objectively and comprehensively. Through the feedback of evaluation, effective suggestions can be provided to improve teachers' teaching qualities and enhance the education level. [2] Middle school PE teachers' evaluation is an important part of teacher evaluation. The reasonableness of evaluation system directly affects the enthusiasm and initiative of physical education teachers, and affects the improvement of teaching quality and the order of school work. [3] However, there are some problems, such as single index and monotonous mode, in the evaluation of physical education teachers in middle schools. The scientific and reasonable evaluation can not be achieved [4][5]. In view of this, it is of great theoretical and practical significance to apply analytic hierarchy process (AHP) to construct an evaluation index system which is suitable for the characteristics of physical education teachers in middle school.

Research Methods

Document research. According to the research content, we consulted more than 80 articles related to our study in CNKI database and Wanfang database. According to the research purpose, we made thorough analyses and summaries on these data.

Interviews. We organized interviews with relevant experts, scholars and teachers through telephone, ground visits and other forms. According to their feedback, we preliminary determined evaluation indexes on middle school PE teachers, which made preparation for questionnaire survey and judgment matrix construction.

Questionnaire survey. To fully understand and grasp evaluation indexes of middle school PE teachers, and construct the corresponding judgment matrix, we gave out 120 copies of questionnaire to domestic experts and scholars in sports field, and recovered 117 valid questionnaires. The effective recovery rate was 97.5%.

Mathematical statistics. We used Microsoft Excel and SPSS20.0 to make statistical analyses of relevant data, including data calculation and AHP analysis.

Results and Analyses

Evaluation indexes on middle school PE teachers. Based on document research and interviews, we created questionnaire on middle school PE teacher evaluation. After statistically analyzing the survey results, we obtained four first grade indicators include routine work, professional accomplishment, professional ability and professional development; and twelve second grade indicators such as teaching and class management. (Table 1) In the evaluation index system of middle school PE teachers, routine work is composed of 3 second grade indexes: teaching, class management and education research; professional accomplishment include 3 second grade indexes: teaching attitude, professional ethics, communication skills; professional ability includes 3 second grade indexes: professional skills, training improvement, competition results; professional development is consist of 3 second grade indexes, teaching research, professional development and professional innovation.

Table 1 Indexes in evaluation system for middle school PE teachers

system	First grade indexes	Second grade indexes
evaluation system for middle school PE teachers (A)	Routine work (B1)	Teaching (B11)
		Class management (B12)
		Educational research (B13)
	Professional accomplishment (B2)	Teaching attitude (B21)
		Professional ethics (B22)
		Communication skills (B23)
	Professional ability (B3)	Professional skills (B31)
		Training improvement (B32)
		Competition results (B33)
	Professional development (B4)	Teaching research (B41)
		Professional development (B42)
		Professional innovation (B43)

The construction of judgment matrix of evaluation indexes. According to the basic requirements of analytic hierarchy process (AHP), it is necessary to construct the judgment matrix according to matrix scaling method. Therefore, on the basis of previous research, interviews to experts and scholars in sports science and physical education teachers were carried out to find out that in comparison between any two factors, which one is important; and to get the importance degree. The assignment of 1-9 (the importance degree was judged according to the scale values shown in Table 2) was made to establish judgment matrix.

Table 2 Scale method on elements of judgment matrix

scale	meaning
1	two factors in comparison are equally important
3	two factors in comparison, a factor is slightly more important than the other
5	two factors in comparison, a factor is obviously more important than the other
7	two factors in comparison, a factor is much more important than the other
9	two factors in comparison, a factor is extremely more important than the other
2, 4, 6, 8	the median of the two adjacent judgments
reciprocal	comparison factor i and j is a_{ij} ; comparison factor j and i is $a_{ji}=1/a_{ij}$

Determination of weight vectors and consistency tests. For each pairwise comparison matrix, we calculated its maximum eigenvalue and eigenvectors, then calculated the consistency ratio with the consistency index and random consistency index, and then tested the consistency with the consistency ratio $CR < 0.1$. If the test was passed, the feature vector (after the normalization through harmonizing method) could become the weight vector. If the test was failed, a new comparison matrix should be constructed. The specific process was as follows:

- (one) uniformization of column vectors in the comparison judgment matrix;
- (two) the sum of the vectors obtained;
- (three) the normalized vectors are normalized;
- (four) the approximate value of the largest eigenvalue obtained;
- (five) calculation of consistency index CI;
- (six) calculation of consistency ratio CR.

The judgment matrix of 4 first level grade indexes, routine work, professional accomplishment, professional ability and professional development was calculated to obtain the maximum eigenvalue $\lambda = 4.05$, weight vector $(0.399, 0.098, 0.107, 0.396)^T$, $CI=0.018$, $CR=0.020$, $CR < 0.1$, passed the consistency test. Detailed results of the first level indicators are shown in table 3.

Table 3 Judgment matrix and test of first grade indexes

A	B1	B2	B3	B4	W	consistency check
B1	1	3	4	1	0.399	
B2	1/3	1	1	1/3	0.098	CR=0.020
B3	1/4	1	1	1/4	0.107	CR<0.1
B4	1	3	4	1	0.396	Pass the check

The judgment matrix of 3 second grade indexes in routine work, namely teaching, class management and education research was calculated to obtain the maximum eigenvalue $\lambda = 3.02$, weight vector $(0.634, 0.260, 0.106)^T$, $CI=0.012$, $CR=0.024$, passed the consistency test. Detailed results are shown in table 4.

Table 4 Judgment matrix and test of routine work

B1	B11	B12	B13	W	consistency check
B11	1	3	5	0.634	CR=0.024
B12	1 / 3	1	3	0.260	CR<0.1
B13	1 / 5	1 / 3	1	0.106	Pass the check

The judgment matrix of 3 second grade indexes in professional accomplishment: teaching attitude, occupation ethics and communication skills was calculated to obtain the maximum eigenvalue $\lambda = 3.01$, weight vector $(0.416, 0.458, 0.123)^T$, CI=0.005, CR=0.009, CR < 0.1, passed the consistency test. Detailed results are shown in table 5.

Table 5 Judgment matrix and test of professional accomplishment

B2	B21	B22	B23	W	consistency check
B21	1	1	3	0.416	CR=0.009
B22	1	1	4	0.458	CR<0.1
B23	1 / 3	1 / 4	1	0.123	Pass the check

The judgment matrix of 3 second grade indexes in, namely professional skills, training improvement and competition results was calculated to obtain the maximum eigenvalue $\lambda = 3.01$, weight vector $(0.690, 0.149, 0.161)^T$, CI=0.004, CR=0.013, CR < 0.1, passed the consistency test. Detailed results are shown in table 6.

Table 6 Judgment matrix and test of professional ability

B3	B31	B32	B33	W	consistency check
B31	1	5	4	0.690	CR=0.013
B32	1 / 5	1	1	0.149	CR<0.1
B33	1 / 4	1	1	0.161	Pass the check

The judgment matrix of 3 second grade indexes in professional development, including teaching research, professional development and professional innovation, was calculated to obtain the maximum eigenvalue $\lambda = 3.09$, weight vector $(0.539, 0.164, 0.297)^T$, CI=0.043, CR=0.083, CR < 0.1, passed the consistency test. Detailed results are shown in table 7.

Table 7 Judgment matrix and test of professional development

B4	B41	B42	B43	W	consistency check
B41	1	3	2	0.539	CR=0.083
B42	1 / 3	1	1 / 2	0.164	CR<0.1
B43	1 / 2	2	1	0.297	Pass the check

To sum up above results of four first grade indicators include routine work, professional accomplishment, professional ability and professional development, and twelve second grade indicators include teaching, class management, education research, teaching attitude, professional ethics, communication skills, professional skills, training improvement, competition results, teaching research, professional development and professional innovation, we used the method of synthetic weight to obtain the final weight of second grade indexes to the general objective, and finally constructed the evaluation index system for middle school PE teachers. Detailed results are shown in table 8.

Determination of the weight of indicators at all levels. General Objective	First grade index	Weight of first grade index	Second grade index	Weight of second grade index
Evaluation system of PE teachers in middle school (A)	Routine work (B1)	0.399	Teaching (B11)	0.253
			Class management (B12)	0.104
			Educational research (B13)	0.042
	Professional accomplishment (B2)	0.098	Teaching attitude (B21)	0.041
			Professional ethics (B22)	0.045
			Communication skills (B23)	0.012
	Professional ability (B3)	0.107	Professional skills (B31)	0.074
			Training improvement (B32)	0.016
			Competition results (B33)	0.017
	Professional development (B4)	0.396	Teaching research (B41)	0.213
			Professional development (B42)	0.065
			Professional innovation (B43)	0.118

Table 8 Evaluation index and index weight in evaluation system of PE teachers in middle school

Conclusions and Suggestions

Conclusions. This paper constructs a comprehensive evaluation index system for Chinese middle school PE teachers through the method of Analytic Hierarchy Process. The evaluation index system includes four first grade indicators, namely routine work, professional accomplishment, professional ability and professional development, and twelve second grade indicators like teaching, class management, education research, teaching attitude, professional ethics and so on. Finally the weight of each index in the evaluation system of middle school PE teachers is obtained.

There are three levels in the evaluation system of PE teachers. The first level is the overall objective of evaluation; the second level is field indicators; the third level is specific indicators in various fields.

Among first grade evaluation indexes, the order of descending weight is routine work, professional ability, professional development and professional accomplishment. Among second grade evaluation indexes, the weights of teaching and teaching research are greatest, followed by class management and professional innovation. As a specific training method in professional sports, training improvement and competition results also get certain weights, which is consistent with the objective reality.

Suggestions. The evaluation for middle school physical education teachers should adhere to the principle of combining subjective evaluation with objective evaluation. It is necessary to make the evaluation become an effective tool to motivate teachers, but the evaluation can not hurt teachers'

enthusiasm. It is a better choice to construct the evaluation index system of teachers in middle school through analytic hierarchy process (AHP), which will make the evaluation more scientific, reasonable and easy to accept.

The evaluation system of middle school physical education teachers established in this study reflects, teaching and teaching research are still in pretty important positions. Therefore, we should pay more attention to the cultivation of teachers' teaching abilities, create more further education and learning opportunities for them, and promote teachers to further strengthen their professional abilities, so as to improve their teaching levels. In addition, teachers should be encouraged to carry out education reform and teaching research, to make innovation in the education process, in order to achieve the maximum teaching effect.

There are many methods to construct teacher evaluation system. In addition to analytic hierarchy process, researchers can also apply other subjective or objective weighting methods. As a whole, each method has its advantages and disadvantages. Therefore, we should make a reasonable choice on the basis of considering characteristics of school physical education. In addition, when constructing other sports related evaluation index systems, the analytic hierarchy process (AHP) also has certain practicality and high reliability.

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