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The Influence of Core Competencies on the Teaching Competence of Chinese Middle School Physical Education Teachers - Based on Analytic Hierarchy Process

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Abstract

Teacher competence refers to the comprehensive ability to be competent in the teaching profession, including motivation, traits, self-image, attitude or values, knowledge in the field of education, cognitive or behavioral skills, etc. This article takes middle school physical education teachers as the research object, based on the new curriculum standards and competency theory, to develop evaluation indicators for the teaching competence of middle school physical education teachers. Through methods such as Delphi method, analytic hierarchy process, and questionnaire survey, the indicator system is continuously revised and improved, and finally a teaching competence model for middle school physical education teachers that adapts to the new curriculum standards is developed. The construction of a teaching competence model for middle school physical education teachers has positive significance for improving the quality of education for middle school teachers, promoting their professional development and career planning.

Keywords: Teaching competence; Model construction; Physical education teacher; Middle school; core competencies

1. Research Object and Method

1.1 Research Object

This study focuses on the teaching competence of middle school physical education teachers, and investigates university scholars, research experts, and frontline physical education teachers.

1.2 Research Methods

1.2.1 Literature analysis method

This study is based on the China National Knowledge Infrastructure (CNKI) database and conducted a thematic search to collect domestic literature on "competence", "teacher

competence", "teacher teaching competence", "physical education teacher competence", and other related topics for classification. The study also referred to the "Compulsory Education Physical Education and Health Curriculum Standards (2022 Edition)" to lay a solid theoretical foundation for this research.

1.2.2 Delphi method

The Delphi method is a subjective and qualitative approach that can be used not only in the field of prediction, but also in the construction of various evaluation indicator systems and the determination of specific indicators. This study conducted interviews with 12 experts, including university scholars, teaching and research experts, and frontline middle school physical education teachers. The research direction is required to be university teachers with associate professor or above titles in school physical education, or middle school physical education teachers with more than 10 years of teaching experience. Create a questionnaire for each indicator and conduct two rounds of expert surveys. Based on the opinions and suggestions of 12 experts and scholars, adjust and modify the teaching competence elements of middle school physical education teachers, and ultimately determine the teaching competence indicators for middle school physical education teachers.

Table 1. Basic Information of Experts

serial number	Name	unit	professional title
1	Zhong XX	Huazhong Normal University	professor
2	Hao XX	Huazhong Normal University	Associate Professor
3	Yuan XX	Southwest University	professor
4	Li XX	Sichuan Agricultural University	professor
5	Liu XX	Sichuan Agricultural University	professor
6	Yang XX	South China Normal University	professor
7	Lu XX	South China Normal University	professor
8	Yang XX	Xianghua Central School	principal
9	Wang XX	Tianjiabing Middle School	Special-grade Teacher
10	Yang XX	Ya'an Education Research Institute	Primary and secondary school teaching and research staff
11	High XXX	Ya'an Second Middle School	Special-grade Teacher
12	Li XX	Yucheng Middle School	Special-grade Teacher

1.3 Mathematical and Statistical Methods

This study will remove invalid questionnaires from the collected survey results according to the requirements, and use SPSS27.0, Excel, software to process the relevant data for data entry, analysis, and model structure fitting.

2. Research results and analysis

2.1 Based on policy analysis, the sources of teaching competence elements for middle school physical education teachers

In recent years, the country has successively issued opinions and plans to promote the construction of the teacher team and the development of school sports. Among them, the "Opinions on Comprehensively Deepening the Reform of Teacher Team Construction in the New Era" [2], "Opinions on Comprehensively Strengthening and Improving School Sports Work in the New Era" [3], "Opinions on Further Reducing the Homework Burden and Extracurricular Training Burden of Students in Compulsory Education" [4], and "Compulsory Education Curriculum Plan and Curriculum Standards (2022 Edition)" [5] are four guiding policy documents that put forward clear requirements for physical education teachers. The keywords mentioned in the above policy documents provide policy guidance for the specific indicators of knowledge, ability, professional values, and other dimensions in the construction of the teaching competence model for middle school physical education teachers in this study, especially the contents of "core literacy", "professional literacy", "teaching ability", "innovation", etc., which must be emphasized in the design of the model.

2.2 Teaching Competency Indicators for Middle School Physical Education Teachers Based on Literature Analysis

Choosing appropriate indicators is the primary task in building a competency indicator system. In order to establish a reasonable index system for the teaching competence of middle school teachers, 31 Peking University core and CSSCI literature related to the competence of physical education teachers were selected and sorted out, and quantitative frequency statistics were conducted on the teaching competence indicators used in these literature. The statistical results show that there are 5 occurrences of knowledge, ability, professional ethics, intrinsic motivation, teaching knowledge, physical education subject knowledge, teaching ability, and teaching evaluation; The four occurrences include personal traits, caring for students, organizational and coordination skills, event organization skills, cooperation awareness,

innovation awareness, and respect for students; The three occurrences include specialized teaching, training knowledge, humanistic knowledge, sports skills, choreography ability, modern technology ability, being a role model, and fairness and justice; There are two occurrences of health education knowledge, interdisciplinary thematic knowledge, sports culture knowledge, curriculum ideological and political construction ability, psychological counseling ability, achievement motivation, interpersonal relationships, role positioning, and personality charm; There are multiple sports abilities, challenge consciousness, innovation consciousness, deep thinking consciousness, lifelong learning consciousness, sports experience, teaching according to students' aptitude, leading by example, professional identity, love for the profession, goal planning, and ideal beliefs that appear once.

2.3 Screening of teaching competence indicators for middle school physical education teachers based on expert consultation

After initially constructing an indicator system based on relevant literature and policy documents, the Delphi method was mainly used to construct and screen various indicators as the construction of the indicators was still in the process of modification. After multiple rounds of expert consultation, opinion summarization, and repeated revisions to the indicator system, the expert opinions were basically reached.

2.3.1 Results and analysis of the first round of expert teacher opinions

The first round of indicators includes 4 first level indicators, 12 second level indicators, and 47 third level indicators. Experts and teachers can make three choices for each indicator: "agree", "disagree", and "suggest", corresponding to "√" and "×", respectively. Expert and teacher suggestions can be modified accordingly. The first round of expert teacher opinion forms was distributed in 12 copies, and 12 copies were collected with a 100% response rate, all of which were valid questionnaires with a 100% validity rate.

First round primary indicators: all retained, secondary indicators: B3 personal ability conflicts with B1 teaching ability [5], deleted; C3 self motivation conflicts with C1 self-evaluation [6], delete; D1 changes moral character to professional ethics [7], C1 changes self-evaluation to self-examination [8]; Change C2 self-management to self drive [9]. Third level indicator: A22: Change "interdisciplinary thematic knowledge" to "interdisciplinary integrated knowledge"; A25 Humanities knowledge, A28 General knowledge, A29 Social adaptation knowledge removal; Conflict between A26 coach knowledge and A27 referee knowledge; B15 error correction ability and B16 expression ability are not representative; Change B31

arrangement ability to "teaching arrangement ability". Delete "teacher" from D31 teacher goal planning and D32 teacher ideal beliefs; Delete items based on indicators such as B17 self counseling ability, B18 scientific research ability, C13 self status, C21 crisis awareness, D24 values, D34 academic rigor, and D35 passion for the profession.

2.3.2 Results and Analysis of the Second Round Questionnaire

After the completion of a round of indicator questionnaires, we actively adopted the valuable opinions of experts and teachers, reorganized various indicators, and achieved complete accuracy and effectiveness. The design of the next two rounds of questionnaires will use the "Likert" five point scale method to score each indicator, with scoring criteria of 5, 4, 3, 2, and 1 corresponding to "very valuable, valuable, average, worthless, and extremely worthless". The second round of questionnaires will still be distributed to 12 expert teachers, allowing them to score their various indicators based on their experience and understanding of various aspects of school sports knowledge and insights. The higher the score of the indicator, the more effective it is, and the more valuable it is for evaluating the teaching of middle school physical education teachers. The experts in this round are all experts who have participated in Delphi. A total of 12 questionnaires were distributed and 12 were collected, with a response rate of 100%. All questionnaires are valid. This round of screening indicators mainly analyzes four data results: coefficient of variation, standard deviation, mean, and coordination coefficient.

From Tables 2 and 3, it can be seen that the average score of the second round of screening for the third level indicators is between 3.5 and 5.0. Among them, the experts and teachers in the "professional attitude" category under the "professional competence" category gave a very low rating, with an average score of 3.5, which is exactly 70% of the pass rate. The reason behind the analysis is still that teachers have a low level of recognition and acceptance of their profession, including the meaning, value, norms, and codes of conduct of the profession. And professional identity is an important component of career development, closely related to personal career satisfaction, job performance, and job stability. A person with high professional identity often demonstrates enthusiasm, sense of responsibility, loyalty, and creativity towards work, fully tapping into personal potential and continuously learning and growing. But currently, it seems that middle school physical education teachers do not have the ability to correctly recognize professional attitudes in the process of physical education teaching, which is why they have such a low average score. In addition, after a series of calculations, the coefficient of variation of the tertiary indicators ranged from 0.000 to 0.105, with a consistency

test P=0.000, meeting the conditions of P<0.01 to P<0.05. Therefore, the three data items meet the requirements of the indicators. Due to limited space, only the statistical analysis data of the third level indicators are listed here.

Table 2. Second round Third level Expert Teacher Rating Table

Third-level indicator	Average	Standard deviation	coefficient of variation
A11 Educational and Teaching Knowledge	4.58	0.243	0.053
A12 Physical Education Science Knowledge	4.67	0.222	0.048
A13 Specialized Teaching and Training Knowledge	4.42	0.243	0.055
A21 Health Education Knowledge	3.92	0.410	0.105
A22 interdisciplinary integration of knowledge	4.36	0.120	0.036
A23 Sports Culture Knowledge	4.26	0.243	0.053
A24 Sports Moral Knowledge	4.83	0.139	0.029
B11 Teaching Design Ability	4.50	0.250	0.056
B12 Teaching Reflection and Evaluation Ability	4.50	0.025	0.056
B13 Psychological counseling ability	3.83	0.139	0.036
B21 interdisciplinary integration ability	4.69	0.013	0.045
B22 Course Ideological and Political Construction Ability	4.23	0.0157	0.056
B21 Arrangement Ability	4.42	0.251	0.039
B22 Organizational and Coordination Capability	4.72	0.076	0.016
B23 Event Organization Capability	4.21	0.354	0.061
C11 interpersonal relationships	3.92	0.243	0.062
C12 Role Positioning	3.58	0.243	0.053
C14 Achievement Motivation	3.75	0.345	0.094
C22 Challenge Awareness	4.33	0.222	0.051
C23 Deep Thinking Consciousness	3.92	0.243	0.053
C24 lifelong learning awareness	4.58	0.243	0.053
D11 is a role model	4.25	0.188	0.044
D12 leads by example	3.83	0.139	0.036
D13 Caring for Students	4.67	0.222	0.048
D14 Fairness and impartiality	4.42	0.243	0.053
D15 teaching according to individual needs	3.97	0.222	0.048

D21 cooperation awareness	3.92	0.410	0.105
D22 Professional Identity	4.75	0.188	0.039
D31 Goal Planning	4.19	0.076	0.016
D32 Ideal Belief	4.51	0.062	0.015

Table 3: Consistency Test of Third Level Indicators in the Second Round

Number of expert teachers	number of indicators	Kendall	Coordination coefficient P
12	31	0.528	0.000

2.4 Constructing a teaching competence model for middle school physical education teachers based on the Analytic Hierarchy Process (AHP)

This study selected multiple factors that affect the teaching competence of middle school physical education teachers based on policy analysis, literature review, and expert consultation. Then, the Analytic Hierarchy Process was used to solve the problem of unreliable multi factor discrimination in the first three methods. The Analytic Hierarchy Process used mathematical methods for weight recalculation to ensure the rigor, objectivity, and completeness of the research results.

To verify the applicability of the model, this study distributed it to teachers for filling out and conducting empirical research, allowing them to compare the importance of indicators in pairwise matrices, retrieve the survey form, import data to validate the model, and conduct data analysis.

2.4.1 Check the consistency of the judgment matrix

The consistency check of the judgment matrix includes whether the weight coefficients of each level meet the requirements of logical consistency check and the overall ranking of the levels

Consistency check. Only by checking the logical consistency of the weight coefficients at each layer can the validity of the judgment matrix be demonstrated and the data be analyzed. The overall ranking refers to the relative weight of each factor in the target layer for each judgment moment. The ratio formula is calculated as follows:$CRj = \frac{\sum_{j=1}^{m} a_j CI_J}{\sum_{j=1}^{m} a_j CI_j}$When $CR \leq 0.1$, it is considered that the overall ranking of the hierarchy is consistent, otherwise the judgment matrix will be readjusted.

Table 4. Weight of Evaluation Indicators for Teaching Competence of Middle School Physical Education Teachers

first-level indicator	weight value	secondary indicator	weight value	third-level indicator	weight value
knowledge literacy	0.525	General cultural knowledge	0.666	Educational and teaching knowledge	0.548
				Theoretical knowledge of sports discipline	0.251
				Specialized teaching and training knowledge	0.158
		Subject specific knowledge	0.333	Health education knowledge	0.520
				Interdisciplinary integration of knowledge	0.200
				Sports culture knowledge	0.078
				Sports moral knowledge	0.200
capability level	0.204	teaching ability	0.548	Teaching design ability	0.416
				Teaching reflection and evaluation ability	0.125
				Psychological counseling ability	0.457
		innovation capability	0.241	Ability to integrate disciplines	0.648
				Course ideological and political ability	0.229
				Information technology capability	0.122
		management skills	0.210	Arrangement ability	0.416
				Organizational and coordination skills	0.125
				Event organization capability	0.475
intrinsic motivation	0.087	Self-evaluation	0.666	interpersonal relationships	0.655
				role positioning	0.186
				achievement motivation	0.157
		self-management	0.333	Deep thinking consciousness	0.633
				Lifelong learning awareness	0.106
				Challenge awareness	0.259
professionalism	0.187	professional ethics	0.589	a model of virtue for teachers	0.490
				set an example	0.192
				Care for students	0.059
				Teach students in accordance with their aptitude.	0.098
				fair and just	0.411
		professional attitude	0.251	professional identity	0.666
				Cooperative awareness	0.333
		career pursuit	0.158	goal programming	0.833
				ideals and beliefs	0.166

2.4.2 Input of judgment matrix and export of results

Compare each indicator of the AHP survey form pairwise through experts. Retrieve the import and finally obtain matrix data. After verification, all matrix CR values are less than 0.1. Due to the involvement of multiple high school physical education teachers in this study, the group decision-making function in YAAHP10.3 software was used to aggregate the first, second, and third level indicator data compared. The judgment matrix was calculated using the power method, and the group decision-making aggregation method was the weighted arithmetic mean of the ranking vectors of each expert. The combined indicators of the second and third level indicators were calculated (as shown in Table 4).The consistency test requirements and overall ranking consistency test CR values were both less than 0.1, so the model passed validation.

2.4.3 Determination of final indicator weights

Through empirical analysis, four primary dimensions including knowledge, ability, intrinsic motivation, and professional ethics were selected, as well as ten secondary competency dimensions including general cultural knowledge, subject specific knowledge, teaching ability, management ability, innovation ability, self-evaluation, self-management, professional ethics, professional attitude, and professional pursuit, and 31 tertiary competency indicators. Based on this, a teaching competency model for middle school physical education teachers was constructed. The dimensions of knowledge and ability belong to the explicit qualities in the quality iceberg model, located above the iceberg and easy to directly perceive and evaluate, and are the fundamental qualities of competence; The dimensions of intrinsic motivation and professional competence belong to the implicit qualities of the quality iceberg model, which are located below the iceberg and have strong stability, and are the core qualities of competence [11].

3. Research conclusions and recommendations

3.1 Conclusion

Education is the great plan of the country and the party. Teachers are the foundation and source of education. The leading role of teachers in the teaching process lies in their ability to

control and regulate various factors and variables in the teaching process to produce the best teaching results. Teaching ability is a necessary psychological characteristic for teachers to master relevant knowledge and skills to successfully complete teaching activities. The teaching competence model of middle school physical education teachers studied in this article has passed consistency testing. According to Table 4, the weight of primary indicators is: knowledge literacy>ability level >Professional competence>intrinsic motivation, secondary indicator judgment matrix table, the results show that the weight of A-class indicators is: general cultural knowledge>disciplinary professional knowledge, B-class indicators is: teaching ability>innovation ability>management ability, C-class indicators is: self-evaluation>self-management, D-class indicators are: professional ethics>professional attitude>professional pursuit. This indicates that the core of the teaching competence of middle school physical education teachers lies in their knowledge literacy. Only with solid knowledge literacy can they shoulder the task of teaching competence in middle school physical education, promote the comprehensive development of students' physical and mental health, and promote the prosperity of sports industry and sports culture. Ability level refers to the performance level of various abilities and skills that teachers need to possess in physical education teaching, including basic teaching abilities such as teaching design ability, teaching reflection and evaluation ability, organizational and coordination ability, as well as new competency factors such as subject integration ability and curriculum ideological and political ability, namely innovation ability. Professional ethics refer to a series of professional qualities and attitudes that middle school physical education teachers need to possess in the teaching process, including being a role model, leading by example, caring for students, fairness and justice, teaching according to individual needs, and maintaining good professional ethics and professional conduct. They also need to maintain continuous self-learning and constantly update their knowledge and skills. Intrinsic motivation refers to an individual's inherent desire, interest, and participation in learning. For a teacher's teaching competence, it is crucial to be able to stimulate, guide, and mobilize the intrinsic motivation of both the teacher and the students. Although the weights of various dimensions are different, teachers need to comprehensively consider these factors to enhance their teaching competence, better promote students' all-round development, and achieve the goal of improving teaching quality and providing high-quality teaching services.

3.2 Suggestions

3.2.1 Establish a comprehensive on-the-job training system for primary and secondary school physical education teachers

As a platform for the work and development of middle school physical education teachers, schools need to provide necessary guidance and support for the development of middle school physical education teachers. Firstly, strengthen the ideological and political education of middle school physical education teachers, and encourage them to attach importance to their professional ethics. Secondly, regular professional skill exchange meetings should be held, inviting experts in relevant fields to "diagnose and assess" the teaching ability of middle school physical education teachers, promoting the improvement of their teaching ability. Thirdly, we should pay attention to the fairness and effectiveness of the performance evaluation system for middle school physical education teachers, comprehensively evaluate their work performance in education and teaching, scientific research, and team training, and make more scientific and reasonable arrangements to enhance their professional identity.

3.2.2 Establishing a Teaching Competence Assessment Mechanism for Physical Education Teachers

Building an assessment mechanism for the teaching competence of physical education teachers requires the joint efforts of school leaders and teachers. By clarifying assessment standards, establishing an assessment system, conducting regular assessments, strengthening feedback guidance, and improving reward and punishment mechanisms, the teaching ability and professional competence of physical education teachers can be improved, and the comprehensive development of students can be promoted. Firstly, clarify the assessment criteria: establish clear assessment criteria, including teaching ability, knowledge literacy, intrinsic motivation, professional competence, and other aspects. The assessment criteria should be operable and measurable to ensure the fairness and accuracy of the assessment results. Secondly, establish an assessment system: establish a multidimensional assessment system, including student evaluation, peer evaluation, expert evaluation, and other methods. Student evaluation can be conducted through methods such as questionnaire surveys and classroom observations; Peer evaluation can be conducted through methods such as listening to lectures, evaluating lectures, etc; Expert evaluation can be conducted through teaching observation, academic exchange, and other methods. Thirdly, regular assessments should be conducted: Schools should regularly assess the teaching competence of physical education teachers, usually once

every semester or academic year. The assessment results should be promptly fed back to teachers to help them improve teaching methods and enhance teaching quality.

Fourthly, strengthen feedback guidance: Schools should enhance feedback guidance on the teaching competence of physical education teachers, and help them improve their teaching level through teaching seminars, training, and other methods. Meanwhile, schools should also provide necessary support and resources for teachers to promote their professional development. Fifth, improve the reward and punishment mechanism: Schools should establish a sound reward and punishment mechanism, reward and commend teachers with high teaching competence, and supervise and guide teachers with low teaching competence. Rewards and punishments can be implemented through methods such as selecting outstanding teachers and establishing reward funds.

3.2.3 Improve the training system for the teaching competence of physical education teachers

Middle school physical education teachers, as the responsible subjects for improving their teaching competence, need to be good guides for students. Firstly, in terms of professional ethics, middle school physical education teachers should adhere to the original intention of cultivating moral character and strictly follow the professional ethics and behavioral norms of teachers. Secondly, middle school physical education teachers should strive to enhance their knowledge and abilities. Middle school physical education teachers should continuously improve their knowledge depth and breadth, strengthen ideological and political learning and innovation and entrepreneurship theory learning, cultivate curriculum ideological and political construction ability and innovation ability, and integrate ideological and political education and innovation and entrepreneurship education knowledge into physical education curriculum education; And understand the psychological laws of students' growth through psychological counseling. Thirdly, innovate educational and teaching methods and means. Fourthly, in terms of intrinsic motivation, middle school physical education teachers should not only stimulate their own sense of achievement, but also maintain a passion for the teaching profession; In addition, attention should be paid to cultivating one's own character such as fairness and leading by example, so as to become a teacher and a model of behavior.

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

Data availability

Data associated with the paper can be accessed on request from the first author.

Author Contributions

This article is written by Haodong Yuan,Jiong Luo are responsible for literature collection and organization. Meanwhile, Luo Jiong is the manager of the project and has approved the author and corresponding author of this study.

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Ethics Statement:

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