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Construction and application effect of coach competency model in volleyball

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ABSTRACT

Constructing a competence model for volleyball coaches tailored to school characteristics has recently gained importance. This study aimed to clarify the competency model construction and its application effect. The study developed a volleyball coach competence model centered on knowledge, skills, professional roles, attitudes, and motivation. A quantitative methodology was used to assess the relationships between these dimensions and coaching performance, emphasizing teaching quality and overall effectiveness. The model drew from theoretical frameworks, including the Iceberg Model and the Onion Model. The sample consisted of 120 volleyball coaches. The correlation analysis revealed significant relationships among knowledge competence, skill competence, professional role, work attitude, work motivation, educational process factors, and educational target factors ($pY1 < 0.05$, $pY2 < 0.05$, and $r > 0.1$). The regression results indicated that gender, professional title, knowledge competence, professional competence, professional role, and work attitude positively influenced the achievement of the competency application effect ($p < 0.05$ and $\beta > 0$). In contrast, work motivation, age, teaching experience, education level, and salary showed no statistically significant impact ($p > 0.05$). Volleyball coaches' competence is essential for effective teaching and training, directly enhancing athletes' skills and performance. The model also improves coaches' quality and application ability, leading to increased athlete satisfaction and better training outcomes.

KEYWORDS

Competency Model; Coach; Volleyball; Construction

1. INTRODUCTION

Volleyball coaches play a crucial role in providing talent assurance for the development of volleyball projects, campus volleyball teaching, and the cultivation of reserve talents. They determine the effectiveness of volleyball teaching reform and are key participants in volleyball teaching, training, event organization, and execution (Cao, 2023). Additionally, coaches serve as important decision-makers, communicators of information, and coordinators of interpersonal relationships in the management of sports teams in schools with a traditional emphasis on volleyball sports characteristics (Chi, 2022). It is precisely due to the multiple roles of volleyball coaches in the management of sports teams in schools with a traditional emphasis on volleyball sports characteristics that the competence of volleyball coaches plays a crucial role in promoting the development of volleyball projects and competitions. Simultaneously, attention to the competence of volleyball coaches is an important guarantee for promoting the development of schools with a traditional emphasis on volleyball characteristics (Li, 2022).

In the environment of traditional sports-focused schools in China, volleyball coaches play a key role in enhancing students' sports skills and improving their physical health (Liu, 2021). However, the current understanding and research on the competence required by coaches and how to accurately assess these abilities are still very limited. Firstly, the competence of coaches includes not only their technical skills and professional knowledge but also encompasses their psychological qualities and teaching strategies. Additionally, the psychological qualities of coaches are crucial; they need to handle pressure, solve problems, and effectively manage relationships with athletes and other coaches (Chen, 2020). Furthermore, coaches need to have an effective set of teaching strategies to provide personalized instruction based on the characteristics of different athletes. Although we have gained some understanding of the competence of coaches, there is still some ambiguity in the specific definition and understanding of these aspects (Zheng, 2020). These issues require further in-depth exploration in both theory and practice.

Based on the above, constructing a competence model for volleyball coaches adapted to the characteristics of schools has become an important topic in current research. This model aims to provide scientific decision-making and improvement directions for schools through the quantitative analysis of coaches' competence, evaluating their teaching quality and effectiveness.

1.1. Study Hypotheses

- Hypothesis 1: There is a significant correlation between the coach's knowledge competence and their overall competence;
- Hypothesis 2: There is a significant correlation between the coach's skill competence and their overall competence;
- Hypothesis 3: There is a significant correlation between the coach's professional role and their overall competence;
- Hypothesis 4: There is a significant correlation between the coach's work attitude and their overall competence;
- Hypothesis 5: There is a significant correlation between the coach's work motivation and their overall competence;
- Hypothesis 6: There is a significant correlation between the coach's gender and their job performance;
- Hypothesis 7: There is a significant correlation between the coach's age and their job performance;
- Hypothesis 8: There is a significant correlation between the coach's years of teaching experience and their job performance;
- Hypothesis 9: There is a significant correlation between the coach's education level and their job performance;
- Hypothesis 10: There is a significant correlation between the coach's professional title and their job performance;
- Hypothesis 11: There is a significant correlation between the coach's technical level and their job performance;
- Hypothesis 12: There is a significant correlation between the coach's salary and their job performance.

2. METHODS

2.1. Study Design and Participants

The method used in this study involved constructing a volleyball coach competence model based on key elements such as knowledge, skills, professional roles, attitudes, and motivation. A quantitative methodology was employed to evaluate the relationships between these competence

dimensions and coaching performance, focusing on the teaching quality and overall effectiveness of volleyball coaches. The model was grounded in theoretical frameworks like the Iceberg Model and the Onion Model (Xu, 2019), which conceptualized competence as layered attributes, with some visible (skills, knowledge) and others underlying (attitudes, motivation). The study also incorporated personal background factors such as gender, age, years of service, education, and salary, which were analyzed for their correlation with coaching competence and job performance. This comprehensive approach integrated theoretical insights with quantitative analysis to construct and validate the competence model.

In this study, the sample consisted of 120 volleyball coaches, providing a robust dataset for evaluating the competence model. The coaches represented a diverse group in terms of demographic and professional background, including variables such as gender, age, teaching experience, education level, professional title, technical level, and salary. These variables offered insight into the coaches' professional development and background.

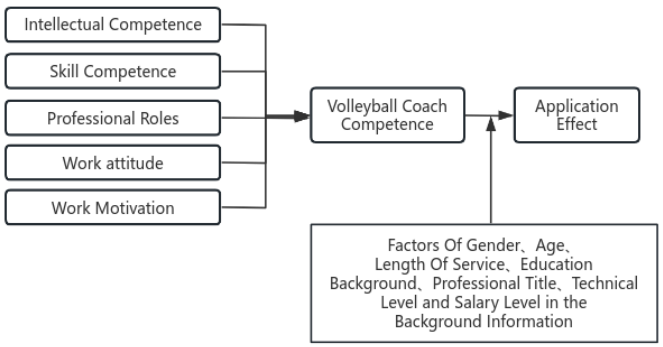

Figure 1. Volleyball Coach Competence Development Model Hypotheses

2.2 Measurement Scale Reliability and Validity Analysis

2.2.1. Validity Analysis of the Measurement Scale for the Volleyball Coach Competence Model

An exploratory factor analysis was conducted on the 20 items across 5 dimensions of the measurement scale for the volleyball coach competence model. The validity coefficient was found to be 0.727, indicating good validity for the questionnaire. Additionally, Bartlett's sphericity test ($P < 0.001$) suggests significant differences (see Table 1).

Table 1. Validity analysis of the measurement scale for the volleyball coach competence model

KMO Quantity of Sample Suitability		**.727**
Bartlett's Sphericity Test	Approximate cardinality	956.088
	Degrees of freedom	190
	P-value	.000

In this study, the total variance explained by the measurement scale for the volleyball coach competence model is 63.621%. After rotation, the component matrix coefficients reveal five common factors as primary components (see Table 2).

Table 2. Rotated component matrix for the volleyball coach competence model

Item		**Components (factors)**				
		1	**2**	**3**	**4**	**5**
Knowledge Reserves	A1 Learning ability of specialized theoretical knowledge	.907				
	A2 Ability to reserve specialized theoretical knowledge	.904				
	A3 Ability to apply theoretical knowledge	.814				
	A4 Ability to teach specialized theoretical knowledge	.753				
Skill Proficiency	B1 Ability to demonstrate specialized skills in teaching		.780			
	B2 Ability to impart specialized skills in teaching		.773			
	B3 Ability to mobilize students to participate in learning		.744			
	B4 Ability to facilitate the realization of learning objectives		.697			
Professional Roles	C1 Coach's ability to impart broad theoretical knowledge			.890		
	C2 Coach's outstanding ability to plan training			.849		
	C3 The coach's ability to demonstrate good teacher ethics			.806		
	C4 Coach's ability to treat students as friends and family members			.832		
Work Attitude	D1 The coach's ability to fulfill his/her duties and responsibilities.				.776	
	D2 Coaches are highly dedicated to their work				.763	
	D3 Coach pursues high quality work				.696	
	D4 Coaches are consciously caring for each student				.688	
Work Motivation	E1 Coach's ability to take the initiative to learn					.785
	E2 Coaches have a strong sense of					.746

responsibility	
E3 Coach's focus on his/her job	.730
E4 Coach's pursuit of excellence	.583

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization.

2.2.2. Reliability Analysis of the Measurement Scale for Volleyball Coach Competence Model

The Cronbach's alpha coefficients for the 20 items assessing the reliability of the five dimensions in the measurement scale for the volleyball coach competence model are 0.872, 0.780, 0.819, 0.744, and 0.693, respectively (Table 3).

Table 3. Reliability analysis of the measurement scale for volleyball coach competence model

Variable Name	Number of items	Cronbach's alpha
A.Knowledge Reserve	4	0.872
B.Skill Reserve	4	0.780
C.Occupational Role	4	0.819
D.Work Attitude	4	0.744
E.Work Motivation	4	0.693

2.2.3. Validity Analysis of the Measurement Scale for the Application Effect of the Volleyball Coach Competence Model

The validity analysis of the application effect scale for the volleyball coach competence model reveals a Kaiser-Meyer-Olkin (KMO) sampling adequacy measure of **0.700**, indicating good validity for the questionnaire. Additionally, Bartlett's sphericity test ($P < 0.05$) suggests significant differences (Table 4).

Table 4. Validity analysis of the measurement scale

Construct Variable Name	Bartlett's Sphericity Test			
	Approximate chi-square	Degree of freedom	Significance	KMO value
4 dimensions with 16 items in the educational process element	1091.877	120	.000	.763
4 dimensions with 16 items in the educational goals element	692.254	120	.000	.663
8 dimensions with a total of 32 items in the application outcomes	2045.960	496	.000	.700

The total variance explained by the questionnaire of the application effect scale for the volleyball coach competence model is 68.797%, indicating that these 8 factors can explain a significant portion of the information in the entire questionnaire. In Table 5, the results of the "Rotated Component Matrix" illustrate that the 8 factors correspond to the 4 factors and 16 items (F1-J4) in the elements of the educational process: "Cognitive Development Process, Skill Acquisition Process, Character Cultivation Process, and Physical and Mental Development Process." Additionally, they relate to the 4 factors and 16 items (H1-N7) in the elements of educational goals: "Achievement of Cognitive Goals, Achievement of Skill Goals, Achievement of Character Goals, and Achievement of Physical and Mental Goals.

Table 5. Rotated Component Matrix

	Factors (Components)							
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
F1. The teaching content is comprehensive and detailed					.766			
F2. The teaching design is clear and easy to understand					.811			
F3. Emphasis on key points and difficulties is clear					.585			
F4. The hierarchy of teaching knowledge is clear and fluent					.740			
G1. The classroom skills explanation is accurate and easy to understand		.687						
G2. The demonstration of skills in the classroom is accurate and elegant		.781						
G3. The organization of skill teaching in the classroom is appropriate		.679						
G4. The teaching methods used are flexible and diverse		.848						
H1. The classroom cultivates students' self-awareness in learning				.829				
H2. The classroom fosters a sense of unity among students				.721				
H3. The classroom enhances students' self-regulation of emotions				.675				
H4. The classroom cultivates a patriotic spirit among students				.773				
J1. Cultivating awareness and behavior of physical exercise	.783							
J2. Capable of proposing solutions to various difficulties	.890							
J3. Shaping a healthy body and balanced personality	.833							
J4. Enhancing the ability to coordinate various interpersonal relationships	.834							
K1. The classroom gains a wealth of theoretical and practical knowledge							.568	

K2. Mastery of the principles and laws underlying the formation of motor skills			.663	
K3. Formation of highly focused behavioral habits			.753	
K4. Improving the ability to identify and analyze problems			.707	
L1. After the class, fully understand and master the movements	.924			
L2. Formation of motor skills through the combination of classroom learning and practice |	.859			
L3. Automaticity achieved in motor skills after classroom learning	.744			
L4. The ability to correctly demonstrate movements after classroom learning	.721			
M1. Striving for outstanding achievements in competition				.638
M2. Pursuing a healthy and enjoyable lifestyle				.796
M3. Developing a tenacious and resilient spirit over time				.813
M4. Forming qualities of unity, progress, and genuine patriotism				.586
N1. Teaching and training enhance physical fitness and promote health		.745		
N2. Entertainment during learning alleviates stress and fatigue		.804		
N3. Filled with confidence, courage, and a sense of challenge		.754		
N4. Formation of awareness and behavior for independent exercise		.821		

2.2.4. Reliability Analysis of the Measurement Scale for the Application Effect of Volleyball Coach Competence Model

Through the reliability analysis of the questionnaire scale for the achievement of goals in the application effect of the competence model for volleyball coaches, the Cronbach's alpha coefficient is 0.830, indicating good reliability of the questionnaire scale for measurement data (see Table 6).

Table 6. Reliability analysis of the measurement scale

Item		Number of Items	Cronbach's Alpha
Elements of the Educational Process	Cognitive Development Process	16	.875
	Skill Acquisition Process		
	Character Cultivation Process		
	Physical and Mental Development Process		
Elements of Educational Objectives	Achievement of Cognitive Goals	16	.645
	Achievement of Skill Goals		
	Achievement of Character Goals		
	Achievement of Physical and Mental Goals		

2.3. Statistical Analysis

The study utilized several statistical analyses to evaluate the volleyball coach competence model. Descriptive statistics provided a summary of the sample characteristics and the five dimensions of the competence model. Exploratory factor analysis assessed the validity of the measurement scale, supported by the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's sphericity test to evaluate the significance of the factor analysis results. Reliability analysis was conducted using Cronbach's alpha to gauge internal consistency. Pearson correlation analysis examined the relationships between competence factors and educational outcomes, while multiple linear regression analysis explored the impact of these factors on the application effect. Additionally, ANOVA was performed to assess the overall significance of the regression model. SPSS was used for data analysis.

3. RESULTS AND DISCUSSION

In the variable assessment of the volleyball coach competence model and its application effect, scores from 1 to 5 represent "relatively unimportant," "unimportant," "important," "relatively important," and "very important," respectively. Table 7 presents descriptive statistics, indicating that, apart from basic sample background information, the variable means for the five dimensions in the volleyball coach competence model range from 2.9667 to 3.6667. This suggests that the sample's

attitudes toward these variables fall between "important" and "relatively important." Additionally, for the application effect of the volleyball coach competence model, the average values for the elements of the educational process and educational goals are 3.2510 and 3.6203, respectively, indicating that the sample's attitudes toward the application effect of the competence model fall between "agreement" and "relatively strong agreement."

Table 7. Descriptive statistics of the volleyball coach competence model and its application effect

Variable Name	Sample	Minimum Value	Maximum Value	Mean	Standard Deviation
1.Gender	120	1.00	2.00	1.3250	.47034
2.Age	120	1.00	4.00	2.2917	.72640
3. Teaching Experience	120	1.00	4.00	2.0500	.84863
4. Education Level	120	1.00	3.00	2.0667	.67030
5. Professional Title	120	1.00	4.00	2.7000	.71714
6.Technical Level	120	1.00	4.00	2.5083	.59403
7. Salary	120	1.00	4.00	2.7000	.72876
A. Knowledge Competence	120	2.00	4.75	3.0937	.64501
B. Skill Competence	120	1.50	4.75	2.9458	.71976
C. Professional Roles	120	2.25	5.00	3.4750	.67394
D. Work Attitude	120	1.75	5.25	2.9667	.61659
E. Work Motivation	120	2.25	5.00	3.6667	.47999
Y1. Dependent Variable - Educational Process Elements	120	2.19	4.44	3.2510	.48480
Y2. Dependent Variable - Educational Goal Elements	120	2.88	4.38	3.6203	.28545

The results of the Pearson correlation coefficient analysis (Table 8) indicate the following: First, skill proficiency (B) and professional roles (C) each show significance at the 0.01 level with the educational process elements (Y1), with correlation coefficients greater than 0.5. Additionally, work attitude (D) shows significance at the 0.05 level with Y1, with correlation coefficients exceeding 0.1. Second, knowledge competence (A), skill competence (B), and work attitude (D) each show significance at the 0.01 level with the educational goal elements (Y2), with correlation coefficients all greater than 0.2. This suggests that knowledge competence (A), skill competence (B), professional roles (C), and work attitude (D) have a significant positive correlation with both the educational process elements (Y1) and the educational goal elements (Y2).

Furthermore, an analysis of the correlations between the factors of the volleyball coach competence model—knowledge competence (A), skill competence (B), professional roles (C), work

attitude (D), and work motivation (E)—and the dependent variable of the application effect (Y) reveals that skill proficiency (B), professional roles (C), and work attitude (D) each show significance at the 0.01 level with the elements of the application effect, with correlation coefficients all greater than 0.5. This indicates a significant positive correlation between these three factors and both the educational process elements (Y1) and the educational goal elements (Y2). Autocorrelation relationships among the factors are not the focus of this study, so further exploration is unnecessary (see Table 8).

Table 8. Correlation analysis of volleyball coach competence model factors

Variable	Y	Y1	Y2	A	B	C	D	E
Y	1							
Y1	.896**	1						
Y2	..655**	.138	1					
A	.156	.003	.312**	1				
B	.715**	.574**	.274**	.093	1			
C	.665**	.786**	.053	.123	.349**	1		
D	.500*	.186*	.503**	-.075	.104	.247**	1	
E	-.101	-.165	-.068	-.103	-.205**	-.117	-.058	1

*P < 0.05; **P < 0.01。

In the multiple linear regression analysis of this study (Table 9), gender, teaching experience, education level, professional title, technical level, and salary were included as control variables to prevent interference from sample background information. The purpose of the regression analysis is to examine causal relationships, typically used for hypothesis testing. This study investigates the impact of the five factors (A-E) on the achievement of goals in the application effect of the volleyball competence model (Y).

Multiple linear regression analysis requires interpretation of the F-test (ANOVA), R^2, significance tests for independent variables (t-tests), as well as the Durbin-Watson (D-W) value and Variance Inflation Factor (VIF). In Table 9, "Model Summary," the adjusted R^2 is 0.818, indicating that the five factors—knowledge competence (A), skill competence (B), professional roles (C), work attitude (D), and work motivation (E)—explain 82.2% of the variance in the sample's competence application effect. This suggests a strong model fit. Additionally, the D-W value of 2.041, which is close to 2, indicates no autocorrelation.

Table 9. Model Summary[b]

Model	R	R2	Adjusted R-squared	Standard Error of the Estimate	D-W value
1	.917a	.840	.822	.13089	2.041

a. Predictive Factors: (Constant), A Knowledge Competence, B Skill Competence, C Professional Roles, D Work Attitude, E Work Motivation, Gender, Teaching Experience, Professional Title, Education Level, Technical Level, Salary.

b. Dependent Variable: Achievement of Goals in the Application Effect of the Volleyball Coach Competence Model.

In Table 10, the "ANOVA" analysis shows that the model's P-value is 0.000, less than 0.01, indicating that the model has passed the F-test (ANOVA test). In the 5 factors of knowledge competence (A), skill competence (B), professional roles (C), work attitude (D), and work motivation (E), at least one has an impact relationship with the achievement of goals in the competence application effect. Therefore, the model is suitable for linear regression analysis.

Table 10. ANOVA results for the volleyball coach competence model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.652	12	.804	46.948	.000[b]
	Residuals	1.833	107	.017		
	Total	11.485	119			

a. Dependent Variable: Achievement of Goals in the Application Effect of the Volleyball Coach Competence Model;

b. Predictive Factors: (Constant), A Knowledge Competence, B Skill Competence, C Professional Roles, D Work Attitude, E Work Motivation, Gender, Teaching Experience, Professional Title, Education Level, Technical Level, Salary.

According to Table 11, the P-values for the four variables of knowledge competence (A), skill competence (B), professional roles (C), and work attitude (D), as well as the control variables of gender, professional title, and technical level, are all less than 0.05, indicating statistical significance. This suggests that these four independent variables, along with the control variables (gender, professional title, technical level), significantly impact the achievement of goals in the application effectiveness of competence. Conversely, the P-values for work motivation (E), age, teaching experience, education level, and salary are all greater than 0.05, indicating no statistical significance. Therefore, these five variables do not affect the achievement of goals in the application effectiveness of competence.

Additionally, the regression coefficients (B values) for gender, professional title, technical level, knowledge competence (A), skill competence (B), professional roles (C), and work attitude (D) are all greater than 0, signifying a positive impact on the achievement of goals in the application effectiveness of competence. Consequently, this study establishes seven hypotheses: three control variables (gender, professional title, technical level) and four influencing factors in the competence

model (A-D). The remaining five hypotheses are not established, which include one influencing factor (work motivation) and four control variables (age, teaching experience, education level, salary).

Table 11. Coefficients of the competence model

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model	**B**	**Standard Error**	**Beta**	**t**	**Sig.**	**Tolerance**	**VIF**
Intercept	1.418	.159		8.942	.000		
1. Gender	-.056	.027	-.085	-2.050	.043	.876	1.141
2. Age	-.007	.015	-.018	-.462	.645	.932	1.073
3.Coaching Experience	-.011	.028	-.026	-.392	.695	.350	2.859
4. Education	.022	.029	.046	.740	.461	.383	2.613
5. Title	.077	.029	.188	2.685	.008	.305	3.283
6.Technical Level	.079	.028	.184	2.841	.005	.355	2.819
7. Salary	-.008	.030	-.021	-.279	.781	.270	3.698
A. Knowledge Reserve	.088	.019	.183	4.592	.000	.935	1.069
B. Skill Level	.163	.020	.377	8.115	.000	.691	1.447
C. Professional Role	.148	.023	.321	6.366	.000	.586	1.705
D. Work Attitude	.143	.021	.283	6.844	.000	.870	1.150
E. Work Motivation	-.038	.042	-.059	-.923	.358	.361	2.771

a. Dependent Variable: Achievement of the Application Effectiveness Goal of the Volleyball Coach Competence Model

The VIF values corresponding to the five factors of the volleyball coach competence model are all less than 5, indicating no multicollinearity among the variables in the questionnaire for the factors influencing the competence model and the achievement of the application effectiveness goal. Therefore, when conducting linear regression analysis, the model formula (Formula for the Application Effectiveness of the Volleyball Coach Competence Model) can be presented as follows:

Achievement of the Application Effectiveness Goal = 1.348 - 0.056 × Gender - 0.007 × Age - 0.011 × Coaching Experience + 0.022 × Education + 0.077 × Title + 0.079 × Technical Level - 0.008 × Salary + 0.088 × Knowledge Competence + 0.163 × Skill Competence + 0.148 × Professional Role + 0.143 × Work Attitude - 0.038 × Work Motivation.

For the seven control variables of gender, age, coaching experience, education, title, technical level, and salary, gender, education, title, and technical level are treated as dummy variables, while age, coaching experience, and salary are considered quantitative data and do not need to be set as dummy variables.

4. CONCLUSIONS

Volleyball coaches' competence plays a crucial role in teaching and training, directly impacting their ability to scientifically guide training and enhance athletes' technical skills and competitive performance. This paper constructed a competence model for volleyball coaches based on factors such as knowledge competence, skill competence, professional roles, work attitude, and work motivation. The model was evaluated comprehensively through the cognitive development process, skill acquisition process, character cultivation process, physical and mental development process, as well as the impact on the achievement of cognitive, skill, character, and physical and mental goals. The findings indicated that the model contributed to improving the overall quality and application abilities of coaches, thereby enhancing athlete performance and satisfaction. Additionally, the competence of volleyball coaches positively influenced the construction of professional volleyball teams and the effectiveness of training. To better support the work of volleyball coaches, future research should focus on further refining the competence model for volleyball coaches and applying it to other types of coaching and athlete development for broader practical value. Simultaneously, it was hoped that this study would generate increased attention and research on the professional development of coaches, collectively fostering the continuous development of volleyball.

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AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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