

# **Construction and inspection of competency characteristic model of Marine PE teachers in Colleges and universities- -Take Shandong Jiaotong University as an example**

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**Abstract.** After China implemented the strategy of "maritime power" strategy, maritime sports have achieved great development. The teaching and organization ability of navigation and sports teachers attracts the attention of the general society. The paper constructs the competency characteristic model of Marine physical education teachers through behavioral event interview method, Delphi method, exploratory factor analysis method and validation factor analysis method, and conducts the validation factor analysis in the later stage. The results show that the Marine PE teachers' competency characteristic model consists of six factors, namely cognition, management, motivation, interpersonal communication, self-improvement and professional quality. The total interpretation rate is 92.284%, effectively explaining the competency characteristics of the Marine PE teachers. This research can provide theoretical guidance and practical basis for the development of Marine physical education teachers, and lay an important foundation for the ability improvement of Marine physical education teachers.

**Keywords:** sea-related physical education teacher; competency; characteristic model

## **1. Introduction**

The implementation of the strategy of "maritime power" has promoted the construction and promotion of China's maritime personnel training system, and sea-related sports can play a more comprehensive role. The training of Marine professionals in Chinese colleges and universities attaches great importance to theory and engineering practice, but insufficient attention is paid to the connection between the physical quality and future occupation of Marine professionals, and the lack of teachers and professional level of Marine PE teachers and team development lacks theoretical guidance.

## **2. Method**

This study takes the construction and verification of the characteristic model of Marine PE teachers in colleges and universities, and takes 77 Marine PE teachers in colleges and universities.

### **2.1 Behavioral event interview method**

Research over a period of three months respectively to interview 77 Marine professional teachers, experts, through the key events combined with Marine sports teachers conduct Marine sports course professional characteristics interview outline, through the sea sports teachers key events mining and review, competency characteristic information for the sea sports teachers in colleges and universities.

### **2.2 The Delphi Law**

According to the characteristics obtained by the behavioral event interview method, the questionnaire of Marine PE teacher competency characteristics elements was designed, and three rounds of expert questionnaire survey were conducted on 25 experts and teachers. The questionnaire was designed with the Likert five-level scale, and the relevant experts filled in the questionnaire according to their cognition, and the comprehensive questionnaire results determined

the competency characteristic scale of the navigation and PE teachers in this study. After the formation of the questionnaire, 77 navigation and physical education teachers and experts selected from colleges and universities were distributed and recovered, 77 questionnaires were distributed, invalid questionnaires, wrong-filled and missing questionnaires were proposed, and 75 valid questionnaires were obtained. According to the relevant data, the competency characteristics of Marine PE teachers were obtained, which was used as the basis of exploratory factor analysis.

### 2.3 Exploratory factor analysis

The questionnaire was designed according to the results of the competency characteristics of teachers in Marine physical education, distributed to teachers and collected. The questionnaire data were statistical and principal component analysis, and the number of common factors was judged by the KMO test and common factor variance statistics, total variance interpretation rate and gravel plot.

### 2.4 Validation factor analysis

The path map construction and validation factor analysis were conducted using AMOS software, and the maximum likelihood method was used to verify the front model, observe the subordinate variable relationship between each common factor and fit the model. After fitting, the model was evaluated and analyzed by chi-square test, ratio of degree of freedom, modified goodness-of-fit index and goodness-of-fit index.

## 3. Results and analysis

### 3.1 Evaluation and measurement table of nautical PE teachers in colleges and universities

We study the influencing factors of the competency characteristic model of Marine PE teachers through the Delphi method. A total of three rounds of expert opinion consultation were conducted, according to the concentration degree of expert opinion (mean index score:  $M_t \geq 0.4$ ) And coordination degree (coefficient of variation  $V_t \leq 0.25$ ), the calculation formula is:

$$M_t = \frac{1}{m} \sum_{k=1}^m X_{tk} \quad S_t = \sqrt{\frac{1}{m} \sum_{k=1}^m (X_{tk} - M_t)^2} \quad V_t = \frac{S_t}{M_t}$$

Mean of the t index:  $\bar{X}_t$ , standard deviation of the t index:  $S_t$ , mean of the t index:  $M_t$ . The assessment scale of competency characteristics of Marine physical education teachers in universities is finally determined, as shown in Table 1:

Table 1 Content of the competency characteristic model of Marine physical education teachers in institutions of higher learning

order number	feature	order number	feature
F	analyzing ability	F17	Emergency response
F2	Planning ability	F18	Deal with problems
F3	Talent identification ability	F19	the spirit of dedication
F4	summarize	F20	deal with interpersonal relationships
F5	Innovative processing	F21	Attitude and behavioral influence
F6	Training target designation	F22	Teacher role positioning
F7	Application of means and methods	F23	Interpersonal coordination
F8	Class cohesion	F24	goal-oriented
F9	Realize the expected teaching objectives	F25	the pursuit of success
F10	Authority and management	F26	focus on one's work
F11	feeling	F27	Innovative teaching
F12	thought	F28	Forward-looking treatment of problems
F13	Emotional grasp	F29	Active work
F14	self-control ability	F30	Information acquisition awareness
F15	Self-confidence independence	F31	active learning
F16	Concept update	F32	Teaching and practice supervision

### 3.2 Characteristic model of competency of Marine physical education teachers in colleges and universities

#### 3.2.1 Confirmation of the competency characteristics of Marine physical education teachers in universities

The questionnaire data was processed, and the critical ratio method was used to determine the decision value (CR value). According to  $CR < 0.05$ , this index shows that the significance is the evaluation standard of Marine sports teachers in institutions of higher learning, while it needs to be deleted and does not meet the standard[1].

Table 2 competency characteristics of Marine physical education teachers

metric	group	mean	standard deviation	metric	group	mean	standard deviation
F1*	1.00	4.24	0.8276	F17*	1.00	4.19	0.5788
	2.00	2.77	0.3934		2.00	2.66	0.2318
F2*	1.00	4.37	0.4971	F18*	1.00	4.34	0.6423
	2.00	2.99	0.2846		2.00	2.17	0.2261
F3*	1.00	4.55	0.7623	F19*	1.00	4.48	0.7644
	2.00	3.29	0.3897		2.00	2.15	0.2987
F4*	1.00	4.61	0.8671	F20*	1.00	4.57	0.8731
	2.00	3.54	0.5983		2.00	2.92	0.3385
F5*	1.00	4.37	0.4791	F21*	1.00	4.41	0.7941
	2.00	2.93	0.2582		2.00	2.97	0.5822
F6*	1.00	4.33	0.6194	F22*	1.00	4.53	0.6914
	2.00	2.72	0.3137		2.00	3.22	0.3317
F7*	1.00	4.49	0.5025	F23*	1.00	4.34	0.5025
	2.00	3.51	0.3652		2.00	3.41	0.3652
F8*	1.00	4.37	0.6407	F24*	1.00	4.39	0.6047
	2.00	3.41	0.4102		2.00	3.08	0.4502
F9*	1.00	4.77	0.7645	F25*	1.00	4.61	0.4576
	2.00	3.59	0.4273		2.00	3.59	0.7342
F10*	1.00	4.43	0.6351	F26*	1.00	4.55	0.5361
	2.00	3.31	0.4288		2.00	3.32	0.8248
F11*	1.00	4.34	0.4317	F27*	1.00	4.39	0.4173
	2.00	3.41	0.3077		2.00	3.28	0.3471
F12*	1.00	4.59	0.7212	F28*	1.00	4.44	0.7633
	2.00	3.46	0.7103		2.00	3.51	0.5031
F13*	1.00	4.23	0.5366	F29*	1.00	4.47	0.5663
	2.00	3.28	0.4833		2.00	3.27	0.4338
F14*	1.00	4.59	0.6286	F30*	1.00	4.57	0.6862
	2.00	3.71	0.3927		2.00	3.51	0.3279
F15*	1.00	4.31	0.8552	F31*	1.00	4.37	0.8525
	2.00	3.52	0.5194		2.00	3.29	0.5941
F16*	1.00	4.37	0.6934	F32*	1.00	4.61	0.6349
	2.00	3.42	0.5328		2.00	3.31	0.5283

Independent sample T test was conducted according to spss to obtain the significant level of equal score difference of each competency feature index. Judging by the CR value, the results showed that all the 32 feature values were significantly different, which could be used as the evaluation standard to evaluate the competency characteristics of Marine PE teachers in colleges and universities.

### 3.2.2 Exploratory factor analysis

Table 3 KMO and Bartlett spherical tests

KMO detection system values		.793
Bartlett Spicity Test	Approximate chi square	8977.347
	free degree	3138
	conspicuousness	.000

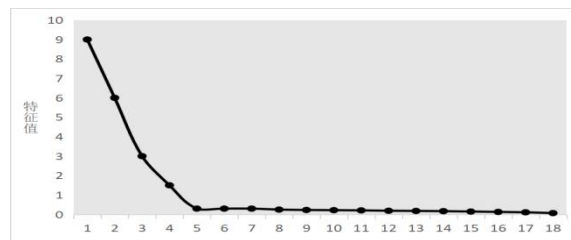
According to the Kaiser metric, the KMO test coefficient =0.793> 0.6, ranging between 0.7 and 0.8, has little correlation between variables, and is suitable for factor analysis. Bartlett Spherical Test  $X^2=0.00 < 0.05$ , indicating that there is a correlation between the original variables, and it is suitable for factor analysis.

Table 4 The total variance breakdown table for the factor analysis

factor	characteristic root	Contribution rate of variance	Variance cumulative contribution rate
1	12.739	58.664	58.664
2	8.554	10.784	69.448
3	3.241	8.879	78.327
4	2.561	6.811	85.138
5	1.988	4.762	89.900
6	1.289	2.384	92.284
.....	.....	.....	.....
16	0.085	0.305	100.00

Eigenvalues greater than 1, or a cumulative variance rate greater than 80% were used as a criterion for determining the number of factors by an exploratory factor analysis. The factor attribution is determined according to the size of the factor load, the index with load greater than 0.4 is significant, greater than 0.5 is significant, and the consideration lower than 0.4 is deleted[2]. According to the principal component analysis method, the interpretation rate of the top 62-1 cumulative variance was 92.284% and over 60%, indicating that 6 factors can extract 92.284% of the information among the 32 factors.

Figure 1 Eigenvalue Gram Map



According to the results of the gravel diagram, the tilt Angle is basically flat after the sixth factor, indicating that the first six factors contribute the most to the overall interpretation of the factors, so it is appropriate to retain 6 factors. The larger the factor tilt ratio in the gravel diagram, the greater the interpretation rate of factor variation.

The results show that: factor 1 is included Analysis ability, planning ability, talent identification ability, induction and summary, innovative processing Five feature metrics, factor 2 contains Training goal formulation, application of means and methods, class cohesion, realization of expected teaching objectives, authority and management Five feature metrics, factor 3 contains Emotion, thinking, emotional grasp Three characteristic metrics, factor 4 contains Self-control, confidence and independence, concept renewal, emergency response, dealing with problems, dedication Six characteristic indicators. Factor 5 contains Deal with four characteristic indicators: interpersonal relationship, attitude and behavior influence, teacher role positioning, and interpersonal relationship coordination. Factor 6: clear goals, the pursuit of success, work focus, innovative teaching, forward-looking problem handling, active work, information acquisition awareness, active learning, and teaching and practice supervision. According to the expert advice and the characteristics of each factor, it will be Factor 1 is named as specialized cognition, factor 2 is management, factor 3 is motivation, factor 4 is self-improvement, factor 5 is interpersonal communication, and factor 6 is professional literacy.

Table 6 Results of internal consistency reliability statistics within the questionnaire

dimension	cognition	manage	motive	improve oneself	interpersonal communication	Midnight literacy	Total amount of table
Cronbach, $\alpha$	0.766	0.791	0.747	0.822	0.817	0.827	0.871

The study used spss, and the results showed the total tableCronbach,  $\alpha$  =0.871, while the six dimensions of the Cronbach, The coefficients were greater than 0.7, and the reliability performed well[3].

### 3.2.3 Analysis of confirmatory factors

According to the results of exploratory factor analysis, it is known from the fact that the six dimensional structural models of the competency characteristics of Marine physical education teachers in colleges and universities are well supported by the data to verify the rationality of the model. Based on the AMOS research, the software is used to verify the factors to analyze the questionnaire data[4].

Referring to the model criteria of bogozzia and Yi[4]To evaluate the model fit of this study, the model path showed that the standardized regression coefficient of each observed variable was in an acceptable range, and the correlation coefficient between the six factors was higher than 0.6, indicating that the six factors could better explain the competency characteristics of Marine physical education teachers in colleges and universities.

Table 9 Fitting results of college basketball teachers in ideological and political horizon N=75

Inspection index	X <sup>2</sup>	df	X <sup>2</sup> /df	AGFI	GFI	IFI	CFI	RMSEA
Inspection value	391.228	196	1.996	0.875	0.931	0.922	0.921	0.0059

The results indicate  $X^2 / df=1.996 < 2$ , indicating good model fit[5]. The AGFI and GFI are the absolute fit index, with the two indices greater than 0.9, respectively, indicating a good model fit[6]. GFI, IFI, and CFI as the relative fit indicators, the closer to 1, the better the fit, the results of this study show that the model fit is better[7]. RMSEA as the absolute fit error, the smaller the data, the higher the fit, 0 represents the complete fit, the results of this study indicate the model fit of 0.0059, close to the fit[8]. The overall results show that the level of each index in the Li characteristic model is high and ideal, and the model verification results are good.

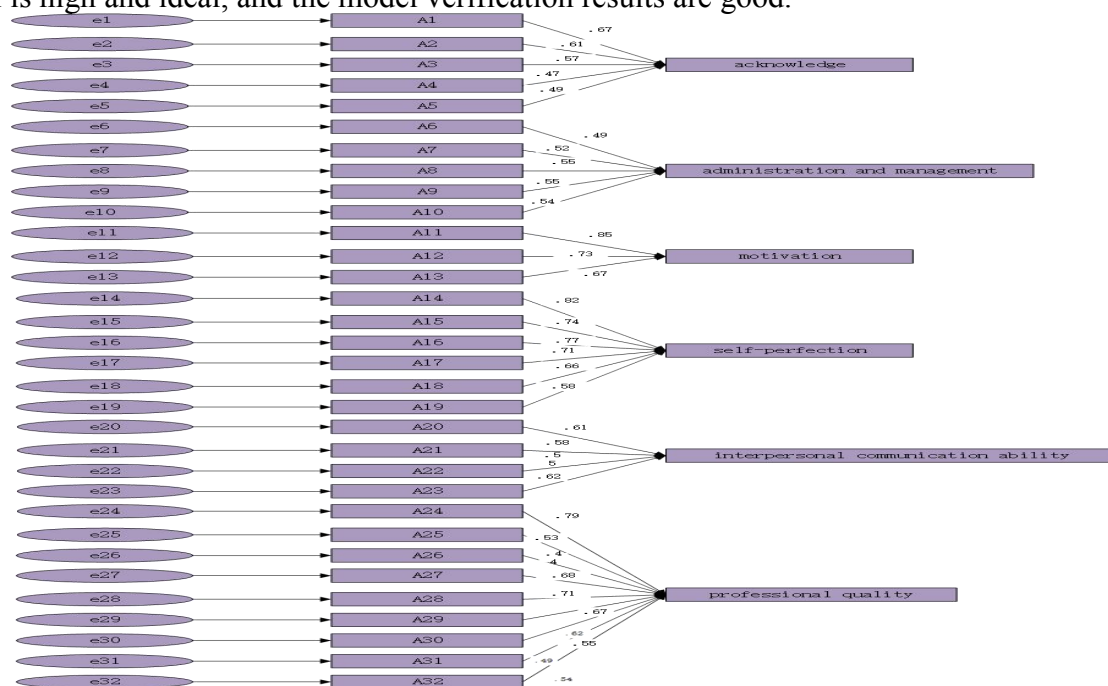


Figure 2 The standardization path model of competency structure of Shahai PE teachers

#### 4. Conclusion

Colleges and universities Marine sports teachers competent characteristics model contains cognition, management, motivation, self-improvement, interpersonal communication, professional quality six dimensions, 32 characteristics, through the exploratory factor analysis and validation factor analysis, the six-dimensional model fitting level is higher, can reflect the Marine sports teachers competent characteristics, for the development of Marine sports teachers and improve provide important theoretical basis.

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