MATHEMATICAL MODELLING AND ENGINEERING PROBLEMS
Vol. 1, No. 1, 2014

RESEARCH ON INDEPENDENT COLLEGE TEACHERS' TEACHING ABILITY BASED ON FACTOR ANALYSIS IN SPSS

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ABSTRACT

Factor analysis and principal component analysis are commonly used in multivariate statistical analysis. We select a sample survey of the status of Guangxi Independent Colleges of teaching ability and their statistical summary results, use statistical software SPSS to carry on the factor analysis, and get comprehensive score. At last, we analyze the influential factors of independent college teaching ability to provide independent college with support and strategy.
Keywords: independent college; teaching ability; factor analysis; SPSS

1. INTRODUCTION

Independent College meets the challenge of shift of China's higher education from elite education to popular education transformation between the late 20th century and early 21st century, and such colleges aim at satisfying the growing demand for higher education needs. It also is our country's higher education system reform and the educational model reform process, which has made great contribution to the rapid development of higher education in recent years. Therefore, the quality of independent college's education has caused widespread concern, for the quality of education is the life of a university. It is clear that the improvement of education quality is closely related to teachers' teaching ability. Therefore, improving teachers' teaching ability is critical for independent colleges, which is also an important task for the government, education authorities and schools.

In order to better understand and further research the current situation of the Guangxi independent college teaching ability of teachers, we based on the teachers' teaching ability in Independent Colleges, carried out a questionnaire survey. In the paper, we use survey data and select some important indexes to assess teachers' teaching ability, and use SPSS software to finish the principal component analysis and factor analysis. By factor analysis, we will obtain some important information on the demands of teaching ability of teachers, which provides references for promoting the Guangxi College teachers' teaching ability training.

2. RELATIVE THEORIES OF FACTOR AND MATHEMATICAL MODEL

The basic idea of factor analysis is based on correlation to group the original variables, to make variable correlation in the same group higher, and in different groups less. Variables in each group integrated with an unobservable comprehensive variable represent a basic structure becomes the public factor.

Factor analysis steps:

(1) According to the specific index in index system to collect original data, let the original data matrix as: $X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}$. Where, m is the number of teachers, n is the number of variables in the index system, x_{ij} (i = 1, 2, m; j = 1, 2, n) is the value of index variable j of teacher i.

(2) Standardization of original data. Because of different dimensions of each indicator in index system, different dimensions will get different class covariance matrix or correlation matrix. To ensure an objective and scientific evaluation results, it is necessary to standardize the original data.

(3) Find the normalized correlation matrix of data $R = (r_{ij})_{m \times n}$, Where r_{ij} is the correlation coefficient of index i and index j.

(4) Calculate the eigenvalue $\lambda_1 \geq \lambda_2 \geq \cdots \geq \lambda_n$ and eigenvector of correlation data matrix $u_1, u_2, \cdots, u_n$. And then get elementary loading matrix $\Lambda_1 = \left[\sqrt{\lambda_1}u_1, \sqrt{\lambda_2}u_2, \cdots \sqrt{\lambda_n}u_n\right]$.

(5) Calculate the variance contribution rate and cumulative variance contribution rate.

(6) Propose common factor. Generally, according to the cumulative variance contribution rate not less than 50% to determine the factors.

(7) Factor rotation. Because factors are not unique, just for the principal component factor is not always practical significance, which needs to coordinate rotation, to look a few common factors has a larger load (the correlation with the variables as large as possible).

(8) Calculate the factor score. Factor analysis is a mathematical model of the variable expressed as a linear combination of common factors:

$x_i = \alpha_{i1}F_1 + \alpha_{i2}F_2 + \cdots + \alpha_{im}F_m$, where $i = 1, 2, \cdots, p,$

in turn, factor can also be used to represent a linear combination of variables:

$F_j = \sum_{i=1}^{p} \beta_{ij} x_i$, where $j = 1, 2, \cdots, m.$. The former function is called the factor score function, which can be used to calculate the score of common factor of each sample.

(9) Calculate the comprehensive score. Determine the weight of each factor score: $W_i = \lambda_i \sum_i \lambda_i$, that is, the contribution rate of the corresponding eigenvalue. The comprehensive score is: $F = W_1F_1 + W_2F_2 + \cdots + W_mF_m.$

3. CASE STUDY

3.1. The samples and data preprocessing

The investigation involves the Guangxi independent college, 670 teachers from different majors, different professional title, different age, and different disciplines of the background of the teachers. Out of the total 670 questionnaires distributed, 558 copies are valid returned questionnaires. Questionnaire scale of 24 project composition, each program statements from the front side of the faculty teaching, teachers according to their own observation and experience to make "very agree" to "not agree" five level evaluation. In statistical analysis, the registration is quantified score, "very agreed to" count 5 points, "agree" count 4 points, "general" count 3 points, "don't agree with" count 2 points, "is not agree to" count 1 points.

Calculating the KMO value is 0.770 with the statistical software SPSS, the Bartlett value is 1930.608, with a probability of 0.000<0.05, showed a higher correlation between indicators, so think the data of this questionnaire is suitable for factor analysis.

3.2 The course of Factor analysis.

The Application of Factor Analysis in the Case

(1) Open the SPSS software, select the data set. Standardize the original data. Select Analyze → Descriptive Statistics → Descriptives.

(2) Select Analyze → Data Reduction → Factor → descriptives → correlation matrix coefficients. Rotation → VarimaxSorces → Method → Regression. The output is as follows:

Table.1 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	%of Variance	Cumulative %
1	3.288	13.701	13.701	3.288	13.701	13.701
2	1.604	6.684	20.385	1.604	6.684	20.385
3	1.542	6.426	26.811	1.542	6.426	26.811
4	1.421	5.920	32.730	1.421	5.920	32.730
5	1.293	5.388	38.118	1.293	5.388	38.118
6	1.258	5.242	43.361	1.258	5.242	43.361
7	1.098	4.575	47.936	1.098	4.575	47.936
8	1.025	4.273	52.208	1.025	4.273	52.208
9	1.013	4.097	56.305	1.013	4.097	56.305
10	.965	4.021	60.326			
11	.954	3.974	64.300			
12	.855	3.563	67.863			
13	.824	3.432	71.295			
14	.792	3.299	74.593			
15	.779	3.246	77.839			
16	.755	3.144	80.983			

17	.708	2.950	83.933
18	.647	2.694	86.627
19	.632	2.633	89.260
20	.582	2.427	91.687
21	.568	2.365	94.052
22	.564	2.348	96.400
23	.503	2.096	98.496
24	.361	1.504	100.000

From Table 1, we can see the first nine principal components contribution on the sample variance is 56.305%. Therefore, we will extract nine principal components to find out the effective way to promote the independent college teachers' teaching ability.

Using principal component analysis to extract factor, due to the factor loading matrix of the coefficient is more centered, so with the biggest variance orthogonal rotation method to rotation of the factor loading matrix, the rotated factor loading matrix as in table 2.

Table.2 Rotated Factor Matrixes

	Factor								
Demand indicators	1	2	3	4	5	6	7	8	9
Teaching team construction	.068	-.029	.688	.090	-.038	-.014	.026	.012	-.107
Attach importance to teachers' teaching	.702	.002	.104	-.089	-.082	-.020	-.029	.080	.052
Incentive policies and measures of the school	.692	-.115	.047	.044	-.040	-.032	-.001	-.099	.047
Students focus on teachers' teaching	.083	.089	-.104	.072	.152	-.039	.128	.001	.706
Tutor system	.356	-.026	.472	-.037	.219	.038	.187	-.289	.138
Teaching assistant system	.013	3.384 E-05	.604	-.018	-.230	-.023	-.058	.258	.042
Teaching training	.652	.062	-.027	.009	.029	-.080	-.127	.316	.048
Teaching seminars	.434	-.136	.429	-.070	.058	.141	.103	.049	-.190
Ways to enhance the teaching abilities	-.056	.683	-.199	.259	.363	-.183	.119	.129	.043
Teaching competition	.297	.498	-.202	.250	-.141	.252	-.102	-.077	-.117
Work performance relate to appraise	-.035	.068	-.203	.035	.673	-.106	.032	.038	-.021
Performance associate with promotions	-.015	.138	.130	.533	.092	-.051	.191	-.266	-.245
Work performance associate with title	-.059	.127	-.066	.265	.412	-.106	.106	.218	-.474
Teachers' professional morality	.167	.068	.184	.000	.057	.056	.074	.710	-.077
Teaching ability to design	.089	-.053	-.320	-.027	.365	.567	-.103	.114	-.085
Teaching skills	.067	.204	.022	.101	-.156	.470	.313	-.286	-.140
Teaching ability to administrate	-.170	-.045	.184	-.014	-.090	.094	.654	-.032	.037

Ability to self-control	.050	.065	-.165	.276	7.801 E-06	.207	.537	.324	.166
Ability to research	.137	.122	-.112	.133	.043	-.714	-.159	-.077	-.091
Basic teaching skills	-.053	.101	.154	.019	.596	.193	-.182	-.054	.254
Language skills	.008	-.135	.055	.731	.053	.100	-.140	.106	.264
Education theory	.298	.061	-.324	-.055	.241	-.399	.454	-.056	-.074
Taking part in the teaching practice	-.057	.190	-.032	.604	-.002	-.128	.086	.027	-.070
Going out to visit learning	.012	.673	.015	-.171	.196	-.169	-.043	.127	.235

4. CONCLUSION AND RECOMMENDATION

Through factor analysis we can see that teachers in the Guangxi independent college urgently need to improve their teaching ability. In order to quickly and effectively improve teachers' teaching ability, we should try to make an effort in terms of the following several main aspects:

(1) The college teachers' management policy and working environment should be improved and leaders should attach importance to teachers' teaching abilities, and establish diversified teaching ability training system. We should set up the Teacher Development Center in order to improve, develop scientific and reasonable system of continued education.

(2) In order to improve the teaching ability of the young teachers, we should strengthen the construction of teaching teams and improve the basic teaching organizations. We should implement the system of young teachers' teaching assistant and tutor system, make the young teachers learn on the job, improve their teaching ability.

(3) We should strengthen the professional guidance for the development of teachers' teaching skills and improve their ability in terms of design, administration, self-control, communication, and research.

(4) We should build a multivariate evaluation system. We should actively explore a way which does not only suit different ages, different titles and different subjects of teacher, but also it will be related to their title promotion, rewards, employment, etc.

ACKNOWLEDGEMENT

The authors wish to thank the Guangxi Higher Education Teaching Reform Subject of "The research and practice of independent college teachers teaching ability" for contract 2012JGZ153, under which the present work was possible.

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