The Professional Curriculum of Normal Class Educational Technology Based on Factor Analysis

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***Abstract*—Based on the factor analysis, this paper from the student's test scores perspective the normal education technology professional curriculum status firstly. Then it analyzes the existing of the advantages and disadvantages in the curriculum. Finally, it put forward the corresponding courses adjustment Suggestions so as to improve students' comprehensive ability and to satisfy the needs of the community.**

Keywords-Factor Analysis, Education Technology,The Curriculum,Result，SPSS

I. INTRODUCTION

A large number of education information needed to use scientific statistical method to analyze along with the college expansion. Factor analysis as education information is a kind of multivariate statistical analysis, its basic idea is to use a few factor to describe the relationship between the multiple variables and it can make the multiple observation variable into a few not related comprehensive indicators, and the comprehensive index is often cannot be directly observed, but sometimes things are more can reflect the characteristics and nature. A professional course number is always very big, how will this great course boil down to a few ability target make the meaning clearer more representative? This is the very factor analysis can solve.

II. THE METHOD OF FACTOR ANALYSIS

Factor analysis is multivariate statistical analysis method of a kind of, in recent years, with the rapid development of the electronic computer, people will factor analysis method is successfully applied to various fields, making factor analysis theory and method more rich. Of course, the method of factor analysis in the education field of applied more and more.

A. Factor analysis of the basic thought and basic principle

The basic idea of factor analysis [1] is the cheek by jowl with the variable into the same category, and different types of the relationship between independent variables are lower. In the same category in the variable, can imagine is to be a common factor to influence each other high correlation, the common factor, also called the public factor, it is potential and cannot be observed. Factor analysis reflects a reduced-order thought, through the dimension reduction will be high correlation between the variables together, not only easy to extract the characteristics of easy to explain, and reduce the need analysis of variable number and the complexity of the problem analysis.

The basic principle of factor analysis [2] is based on correlation, from the covariance matrix or related matrix of most of the variation due to a few public factor for, and the remaining variation called special factors, so, each kind of variable actually represents a common factor, the basic features of factor analysis is used to find and determine the basic characteristics of the model.

B. The basic model of factor analysis[3]

Set for general $\overline{x} = (x_1, x_2, \ldots\ldots, x_p)'$, the mean vector $E(\overline{x}) = \overline{\mu}$ And covariance matrix $V = (\sigma_{ij})_{p\times p}$ both exist. Factor model of the general form for record:

$$\begin{cases} x_1 = a_{11}F_1 + a_{12}F_2 + \ldots\ldots + a_{1m}F_m + \varepsilon_1 \\ x_2 = a_{21}F_1 + a_{22}F_2 \ldots\ldots + a_{2m}F_m + \varepsilon_2 \\ \ldots\ldots\ldots\ldots \\ x_p = a_{p1}F_1 + a_{p2}F_2 + \ldots\ldots + a_{pm}Fm + \varepsilon_p \end{cases} \quad (1)$$

Each symbol is the following meaning:

- F_1, F_2,……, F_m : Standardization of the observable evaluation index decomposition out independent public factor, they are not observed, its meaning according to the specific circumstances to explain.
- ε_1, ε_2,……ε_p : Is the corresponding index x_i Unique factor, called special factors, It says x_i in public factor can be part of the explanation, a_{ij} is the first i a indicators in the first j a common factor of coefficient, known as the factor loading.

(1) type can be used formula for said: $X = LF + \varepsilon$.

Each symbol is the following meaning:

$X = (x_1, x_2, \ldots\ldots, x_p)'$; $F = (F_1, F_2, \ldots\ldots, F_m)'$; $\varepsilon = (\varepsilon_1, \varepsilon_2, \ldots\ldots\varepsilon_p)'$;

$$L=\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & a_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ a_{p1} & a_{p2} & \cdots & a_{pm} \end{bmatrix} \quad (2)$$

The statistical significance of factor loading matrix [1]:

- a_{ij} : Is the first i an index and j a common factor F_j of the correlation coefficient, It says the linear between x_i and F_j correlation degree. The first matrix I did the first element that I A index x_i depends on the degree of public factor, and A first j F_j column element said Ming first j a public factor and each index contact degree, usually according to a_{ij} size to explain the meaning of public factor.
- A first I do elements of the sum of squares called index x_i common degrees [4], namely $h_i^2=\sum_{j=1}^{m} a_{ij}^2$,By orthogonal factor model, there $\mathrm{var}(x_i)=\sum_{j=1}^{m} a_{ij}^2\,\mathrm{var}(F_j)+\mathrm{var}(\varepsilon_i)$ is namely, $1=h_i^2+\mathrm{var}(\varepsilon_i)$. Thus communalities h_i^2 said all m a public factors on index x_i of the total variance contribution h_i^2, x_i said the original information is m a common factor that up to the higher level.
- A first j column element sum of squares said the first j A public factors F_i on original index provides total variance contribution, namely, $g_j=\sum_{i=1}^{p} a_{ij}^2$; F_j the original index variance contribution for [5]: $a_j=\frac{g_j}{\sum_{i=1}^{p}\mathrm{var}(x_j)}=\frac{g_j}{p}=\frac{1}{p}\sum_{i=1}^{p} a_{ij}^2$;The factor F_j first j a common factor that the more important.

III. THE METHOD OF FACTOR APPLICATION

Taking my school level 2011 education technology professional (normal class) fifty students 32 compulsory course in the first three years of the test scores as the basic material, from students the performance analysis of education technology professional curriculum situation.

The original data from college students' archives management. Scores for points, and the minimum score unit 1, the corresponding due to lack of discipline, such as test cause course no results, recorded as zero; For make-up, remember the last time the make-up examination results, data format as is shown in table 1.

TABLE I. ORIGINAL DATA SHEET

课程 学号	大学语文	大学体育	数据结构	艺术基础	教育传播学	数字逻辑系统	数据库应用
044100201	93	82	79	79	90	71	78
044100202	90	85	83	84	88	63	70
044100203	77	62	89	90	76	73	67
……	……	……	……	……	……	……	……

The brief overview statistical information as shown in figure 1 shows, the processed data are 47 cases is effective.

描述统计量

	N	极小值	极大值	均值	标准差	偏度	
	统计量	统计量	统计量	统计量	统计量	统计量	标准误
多媒体课件设计与制作	47	60	81	67.70212766	4.639754019	0.779713895	0.346570499
计算机基础	47	60	81	69.53829787	4.842859073	0.17823935	0.346570499
邓小平理论	47	61	76	69.87234043	3.486726516	-0.502285 94	0.346570499
法律基础	47	60	82	70.14893617	5.58327753	0.394774351	0.346570499
数据库应用技术	47	60	89	70.72340426	7.826104944	0.306277792	0.346570499
高等数学	47	60	93	71.4893617	9.375899587	0.402555714	0.346570499
高级语言程序设计	47	60	92	71.89361702	9.165706506	0.532132998	0.346570499
毛泽东思想概论	47	62	79	71.9787234	4.209148224	-0.0604996	0.346570499
教育信息处理	47	61	83	72.25531915	3.559849075	0.146318039	0.346570499
计算机网络基础	47	60	86	72.72340426	7.042424631	-0.38321208	0.346570499
网络教育应用	47	60	91	73.95744681	7.198905251	-0.02541898	0.346570499
马克思主义哲学原理	47	62	87	74.19148936	4.901811102	0.160338183	0.346570499
心理学	47	60	90	74.65957447	9.482882968	-0.17689215	0.346570499
数据结构	47	60	94	75.29787234	9.21226709	0.064944778	0.346570499
教育技术导论	47	60	89	75.57446809	6.405651991	0.109292572	0.346570499
教育电视编导与制作	47	60	89	75.76595745	6.843634827	-0.26845634	0.346570499
离子逻辑与系统	47	60	93	76.06382979	8.908726194	-0.25433816	0.346570499
微机原理与接口技术	47	60	96	77.23404255	10.80099183	-0.16090318	0.346570499
马克思主义原理	47	60	85	77.80851064	5.399832114	-1.32903447	0.346570499
多媒体技术基础	47	61	90	77.89361702	6.601166045	-0.20848271	0.346570499
思想道德修养	47	70	85	77.9787234	3.280305936	-0.12698223	0.346570499
现代远程教育	47	60	91	78.55319149	7.640875521	-0.68309485	0.346570499
艺术基础	47	64	89	79.53191489	5.800491223	-0.66707789	0.346570499
大学语文	47	61	97	79.76595745	8.819969353	-0.22495733	0.346570499
教育学	47	60	93	80.40425532	9.140591681	-0.89641371	0.346570499
教育技术研究方法	47	65	92	80.61702128	5.330605608	-0.94190017	0.346570499
教育传播学	47	60	91	81	6.341718324	-0.97908497	0.346570499
数学系统设计	47	60	90	82.89361702	4.607338393	-3.28853978	0.346570499
大学体育1	47	60	99	83.65957447	10.36565524	-0.45882163	0.346570499
可视化程序设计	47	64	94	84.23404255	6.750886467	-0.98413887	0.346570499
教育学学与教的原理	47	80	91	84.9787234	2.566416565	-0.35415314	0.346570499
中小学机器人数学	47	60	96	86.57446809	7.649224686	-2.51639174	0.346570499
有效的 N（列表状态）	47						

Figure 1. Student achievement of descriptive statistical output

IV. SPSS FACTOR ANALYSIS MODELING AND ANALYSIS

A. SPSS parameter Settings

In turn, click on the menu - Analyze Data Reduction - Factor..... Executive factor analysis process, in the Variable list will be in addition to student id outside of all Variable elected to the Variable (s) list as analysis Variable. Which factor extraction method choice principal component method, factor rotation methods select variance maximum rotation method.

B. Output results

Initial variable correlation test. As shown in figure 2 shows, multiple variables between the correlation coefficient is bigger, these variables that between the more significant correlation, and also shows that a necessary factor analysis is carried out.

相关矩阵

	大学语文	大学体育	数据结构	艺术基础	教育伟理	数据结构_	数字逻辑	数据库应	教育学学	微机原理	……
大学语文	1	0.328675	0.324347	0.065375	0.61408	0.34578	0.480214	0.441534	0.511663	0.465655	……
大学体育	0.328675	1	0.048665	-0.03344	0.181897	0.104848	0.065685	0.042495	0.483493	0.346738	……
数据结构	0.324347	0.048665	1	0.047417	0.419738	0.910258	0.589666	0.508642	0.163024	0.445421	……
艺术基础	0.065375	-0.03344	0.047417	1	-0.05969	0.096622	-0.03811	0.174752	-0.10875	0.008726	……
教育伟理	0.61408	0.181887	0.419738	-0.05969	1	0.502634	0.629895	0.561536	0.500887	0.596394	……
数据结构_	0.34578	0.104848	0.910258	0.096622	0.502634	1	0.540147	0.548705	0.254654	0.48209	……
数字逻辑	0.480214	0.065685	0.589666	-0.03811	0.629895	0.540147	1	0.634779	0.153143	0.597863	……
数据库应	0.441534	0.042495	0.508642	0.174752	0.561536	0.548705	0.634779	1	0.286524	0.466274	……
教育学学	0.511663	0.483493	0.163024	-0.10875	0.500887	0.254654	0.153143	0.286524	1	0.35623	……
微机原理	0.465655	0.346738	0.445421	0.008726	0.596394	0.48209	0.597863	0.466274	0.35623	1	……
多媒体技	0.164598	0.18627	0.065237	-0.06946	0.372854	0.162885	0.328009	0.209397	0.274468	0.44978	……
计算机网	0.352423	0.199696	0.411105	-0.03996	0.381618	0.340517	0.430988	0.280602	0.2715	0.451284	……
可视化程	0.314563	0.045588	0.190061	0.066146	0.47325	0.276304	0.424106	0.375687	0.40432	0.410067	……
教育电视	0.473035	0.42493	0.074231	0.063444	0.438285	0.171736	0.357173	0.29466	0.595062	0.421905	……
网络教育	0.431581	0.30278	0.229	-0.05255	0.579032	0.30674	0.582053	0.421146	0.418839	0.569643	……
……	……	……	……	……	……	……	……	……	……	……	……

Figure 2. Correlation matrix overview

KMO inspection and Bartlett spherical inspection. As shown in figure 3 shows, KMO test [6] research between variables of partial correlation, partial correlation calculation when controlling for other factors, so than simple correlation coefficient is small, general KMO statistic is greater than 0.9 effect best, more than 0.7 can accept, 0.5 the following is unfavorable for factor analysis, and in this case KMO value close to 0.9, 0.897 for further proved the feasibility of the factor analysis. Bartlett spherical inspection (7) statistic Sig value is less than 0.01, the negative correlation matrix for unit array of the null hypothesis that the variable is a significant correlation between the correlation matrix, from the conclusion of the agreement.

KMO 和 Bartlett 的检验

取样足够度的 Kaiser-Meyer-Olkin 度量。		.897
Bartlett 的球形度检验	近似卡方	1478.695
	df	780
	Sig.	.000

Figure 3. KMO inspection and Bartlett ball check output

Variance explained table. As shown in figure 4 shows, "the total variance" [8] form gives each common factor had explained variance and its accumulated and. Observation "initial characteristic value" column of "cumulative %" column, the top 12 common factor to explain the accumulative total variance is 78.611%, that is to say the 12 common factor can explain the original variable contains 78.611% of the information. "Extraction sum of squares load" column said without rotation, from the 12 common factor their variance contribution rate information, they and the "initial characteristic value" column of the first 12 column value, for the 12 common factor can explain 78.611% of the total variance.

说明的总方差

成分	初始特征值			提取平方和载入		
	合计	方差的 %	累积 %	合计	方差的 %	累积 %
1	13.182	32.956	32.956	13.182	32.956	32.956
2	2.806	7.016	39.972	2.806	7.016	39.972
3	2.293	5.734	45.706	2.293	5.734	45.706
4	1.996	4.990	50.696	1.996	4.990	50.696
5	1.880	4.699	55.395	1.880	4.699	55.395
6	1.654	4.135	59.530	1.654	4.135	59.530
7	1.512	3.780	63.311	1.512	3.780	63.311
8	1.416	3.540	66.850	1.416	3.540	66.850
9	1.356	3.389	70.240	1.356	3.389	70.240
10	1.204	3.009	73.249	1.204	3.009	73.249
11	1.106	2.766	76.015	1.106	2.766	76.015
12	1.039	2.596	78.611	1.039	2.596	78.611

Figure 4. Variance explain output table

Load matrix. As shown in figure 5 shows, through the observation can be found in this case extraction twelve common factor, the first factor of load look, education information processing, education system design, microcomputer principle and interface technology, digital logic and system, network education application, education and communication six courses have great positive load, these courses are education technology the basis of professional course, therefore the first factor can be defined as the basic theory and computer application factor, and its variance accounted for 32.956%, occupy the first position, in that each common factor, the first factor of the component heaviest, also the most in need; From the second common factor of load look, education television director and production, teaching measurement and evaluation, education study and teaching principle, visual programming four course have larger is load, and data structure, introduction to MAO zedong thought, higher mathematics, ideological and moral cultivation four course in the second common factor have more negative load, especially education television playwright-director is in the second common factor to 0.507 is load, the data structure of 0.414 points the negative load, so the two course open to education technology professional it is very necessary. Can take the second common factor defined as education ability basis and computer programming factor; In the third common factor, the information technology teaching method, teaching measurement and evaluation, modern distance education, teaching system design, information technology and curriculum integration five courses have larger is load and negative load, can the third common factor defined as information literacy ability factor, i.e., access to information, information analysis, information processing and information utilization ability, today is a information society, information literacy for everyone is very important, for education technology professional students is particularly important, so it is necessary to open these courses; In the fourth common factor, psychology have higher negative load, psychology as a teacher must have a course in the teaching process, students' psychological speculation is very important, so let the future teachers to learn this course is very necessary, can be defined fourth common factor for speculation ability factor; Education technology introduction and primary and secondary school robot teaching two courses in the fifth factor of large load, education technology education technology introduction is a compulsory course, it is also education technology professional of introductory courses. Undergraduate course education technology students the jobs of the future in primary and secondary schools to most, along with the development of society, the robot teaching in primary and secondary schools, so learning robot teaching this course is very necessary, it could be defined as education technology of basic factor; In the sixth common factor, education technology research methods, network education application, education to learn and teach of principle and so on to have large negative load, the teacher in the daily teaching is not only to teach and teach, in has a strong teaching ability at the same time should also have a certain scientific research ability, therefore, open education

technology research method is particularly important, can the sixth common factor defined as scientific research ability factor; In the seventh common factor, computer maintenance and maintenance of large load, the teacher should not only make full use of computer serves for the teaching, but also should have some basic knowledge of computer maintenance, or a little bit of problems are likely to make the teaching work hard to smoothly, the seventh common factor defined as computer management factor; Education measurement and evaluation in the first ten common factor in have greater negative load, how to judge the stand or fall of quality education needs scientific education measurement and evaluation of the knowledge as the guidance, only the scientific education measurement and evaluation, to improve teaching and teaching management work, so which can be defined as the teaching quality discriminate factor.

Marxism political economics and Marxism philosophy in the first common factor, the second common factor and the eighth common factor has larger load that set up the two courses is very necessary. College Chinese language and literature, legal basis, den Xiaoping theory, MAO Zedong thought and introduction to a few course, in all the common factor of the load is less, this a few course is a basic literacy, but the basic literacy formation is a long, slow process, rely on the university learning is not enough, and students usually don't study and to test a back to back through, no to enhance the purpose of quality, so the necessity to open such little. Campus network construction and management, digital video system two subjects in each common factor of load is small, the two course features is a professional is too strong, also need strong basic computer you can learn it well, so education technology students in learning the two course time there may be a lot of difficulty, so will the open for elective course is more reasonable.

成分矩阵[a]

	成分											
	1	2	3	4	5	6	7	8	9	10	11	12
大学语文	.732	-.058	-.414	.047	.224	.034	-.071	.019	.205	.076	-.019	.177
大学体育1	.318	.341	-.255	-.137	.093	.432	.011	.569	-.059	.031	.091	-.025
数据结构	.558	-.550	.266	-.052	-.267	.047	.010	.216	.201	.006	.117	.013
艺术基础	.047	-.002	.274	.375	.287	-.383	.110	.357	.043	.064	.123	.414
教育传播学	.809	.012	-.030	-.114	-.112	-.037	.145	-.174	.099	-.102	.062	.102
数据结构上机	.623	-.458	.262	-.140	-.204	.027	.059	.230	.210	-.032	.171	.102
数字逻辑与系统	.766	-.234	.129	.054	-.249	-.015	.029	-.036	-.035	-.161	-.330	-.099
数据库应用技术	.655	-.243	.078	.144	-.156	-.220	-.113	.084	.250	-.048	.054	-.208
教育学学与教的原理	.561	.395	-.337	-.121	-.023	.056	.006	.114	.334	.160	.211	-.039
微机原理与接口技术	.763	.005	.036	-.116	-.120	-.126	.077	.265	-.190	.229	-.033	-.176
多媒体技术基础	.438	.231	-.199	-.039	-.427	-.092	.186	-.086	-.427	.090	.007	-.020
计算机网络基础	.558	-.199	-.038	.115	-.057	.260	.088	-.087	-.320	.423	.076	-.067
可视化程序设计	.630	.359	.262	-.006	.104	-.229	-.159	-.208	.105	-.154	-.030	-.167
教育电视编导与制作	.594	.507	-.103	-.030	.135	.070	-.037	.174	.208	-.164	-.106	.010
网络教育应用	.773	.286	.100	-.007	.048	.071	-.071	-.080	-.092	-.091	-.115	-.217
教学系统设计	.759	.091	-.119	-.133	.004	-.008	.255	-.222	.097	-.133	.128	.213
现代远程教育	.538	.116	-.045	.532	-.083	.081	-.190	.222	-.050	-.057	-.417	.045
教育技术研究方法	.471	.172	.066	-.158	.248	.452	.444	-.116	.164	-.122	.101	-.118
多媒体课件设计与制作	.572	.224	.211	-.203	.202	.163	-.272	.040	-.114	.094	-.235	.008
教育信息处理	.742	-.066	.031	-.305	.064	.057	-.068	-.307	-.203	.132	-.078	.138
中小学机器人教学	.647	.195	.172	.019	.213	-.134	.212	-.072	.010	-.384	-.144	.151
高等数学	.443	-.452	-.198	-.042	.250	-.443	.032	-.020	-.128	.011	.062	-.306
教育技术导论	.554	.115	-.430	.277	.096	-.210	-.061	-.149	-.220	.112	-.001	.174
计算机基础	.597	-.270	-.429	-.056	.020	.120	-.107	.028	-.070	-.017	.221	.030
高级语言程序设计（包含上机）	.631	-.196	-.222	.031	.328	.092	-.249	.175	.140	-.026	-.018	-.146
马克思主义哲学原理	.441	-.068	-.439	-.089	-.433	-.260	.146	-.045	.273	-.033	-.232	-.004
马克思主义政治经济学原理	.847	-.099	.008	-.045	.041	-.084	.004	-.069	-.052	.033	.156	.008
毛泽东思想概论	.540	-.475	.030	-.242	-.029	.174	-.010	.035	-.112	-.191	-.052	.189
邓小平理论和"三个代表"重要思想概论	.276	.063	.165	-.180	-.488	.264	-.311	-.094	.245	.336	-.182	.165
思想道德修养	.291	-.377	.241	.074	.393	.321	.125	-.222	.049	.104	-.338	.151
法律基础	.352	.144	.200	.290	-.254	.080	-.572	-.007	-.177	-.232	.248	.270
教育学	.682	-.304	-.080	.219	.050	-.099	-.019	.010	.044	-.064	-.091	-.025
心理学	.733	-.070	-.085	.039	.324	.020	-.279	.009	-.252	-.030	.132	-.135
数字视频系统	.385	.147	.166	-.513	.078	-.255	.067	.095	-.227	.054	.075	.380
网络程序设计	.457	.166	.506	-.040	-.058	-.109	.311	.305	-.221	.063	-.094	-.171
信息技术教学法	.464	.313	-.093	.479	-.134	-.024	.181	-.301	.137	.191	.090	.051
信息技术与课程整合	.258	.108	.345	-.017	.334	-.271	-.099	-.071	.311	.571	-.016	-.007
教学测量与评价	.628	.452	.236	-.092	-.237	-.164	-.010	.077	.014	-.029	.100	-.095
校园网的构建与管理	.388	-.019	.469	.302	-.021	.251	-.071	-.290	.026	-.075	.404	-.173
计算机维护与维修	.325	-.052	.017	.596	-.082	.230	.434	.163	-.084	.094	.021	.084

提取方法：主成分分析法。

a. 已提取了 12 个成分。

Figure 5. Factor loading matrix

V. CONCLUSIONS

According to above using factor analysis method from the perspective of students' test scores to education technology professional curriculum analysis, we can see that normal colleges education technology professional curriculum should pay attention to teaching ability, information literacy, computer application and maintenance, teaching design ability, research ability and practice ability training. Through the factor analysis from the Angle of quantitative curriculum situation analysis, to overcome the traditional single to qualitative analysis of the shortcomings, so as to optimize the normal colleges and universities education technology professional curriculum. Factor analysis in agriculture, medicine, aviation, etc has been quite widely used, but in the education field of application but is not enough mature, are not perfect, has yet to be made after thorough research.

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