基于属性理论的教师教学质量动态评估

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摘 要：在基于属性坐标学习和分析的静态教师教学质量评估的基础上提出了动态评估方法。目的是能够反映评估者的心理偏好以及随时间变化评估者决策的变化情况，通过人机对话，教师教学质量的动态变化的结果说明了计算机能对决策者的决策行为进行动态跟踪，从中猜测和估算出决策者心理评估标准随各种制约条件动态变化的过程，并使机器具有模拟决策者进行决策的功能。这就突破了传统的评估方法不能随意更改评判者心理权重的局限，更具有实用价值。

关键词：教学质量动态评估；属性坐标学习和分析法；局部满意度；全局满意度；决策；评估
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Teaching Quality Dynamic Assessment in Attribute Theory

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Abstract: Present the dynamic assessment based on static assessment of teaching quality about the analysis and learning method of attribute coordinate. Purpose is to reflect the assessment of the psychology of preferences and decision-making about assessment by time changing, the result of the dynamic changing in teaching quality shows the computer can do dynamic tracking about the decision-making behavior of decision-makers, so it can guess and work out the dynamic process about the psychological assessment of decision-makers under a variety of constraints, and make the machine with a simulation function of decision-making. This not only breaks through the traditional assessment methods that can not arbitrarily change the judge of the limitation of psychological weight, but also has practical value.

Key words: teaching quality dynamic assessment; analysis and learning method of attribute coordinate; local satisfactory degree; global satisfactory degree; decision; assessment

1 Introduction

Teaching quality is the lifeline of school, under a new situation of increasingly competive, how to improve the quality of teaching and enhance the competitiveness of the school has become an important research topic. Thus, the quality of teaching related to the assessment about teaching quality of teachers has also become a very important task. However, the evaluation of the school's own teachers is unsatisfactory, which is mainly reflected in the assessment focused only on the results, regardless of the process. The "dynamic assessment" which is a process of change, taking into the assessment of time factor in many schools is prevalent. It has a clear incentive effect that can enable teachers to enhance the sense of competition and can better motivate their work, enthusiasm, breaking the pattern "good teaching and bad teaching is the same", encouraging advanced and driven backward, encouraging teachers to pursue continuous progress and efforts to improve the quality of teaching.

The characteristics of the learning and analysis of the attribute coordinate is that the assessment methods are close to people's normal mode of thinking, it reflects the psychology preferences about assessor and the curve of those preferences. This not only breaks through the traditional assessment methods which can not arbitrarily change the limitations of psychological weight[1,2] of the judge, but also has practical value. But so far, the main research directions of the related literature concentrated in

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the study and analysis of properties are concentrated in the static assessment study, have little time to consider the variables of the dynamic assessment[3] research. However, the assessment of real life, many are related with time and environment, if time and environment is different, the considering properties will be different, and therefore the psychological standard point is different from the original and satisfactory function also changes that leads to a different decision - making. For example[3], young people know each other and mutual contacts then subsequently became close friends in the process, the increase properties cause the sense changed. This assessment is not only a summary of research findings on the current system, but also has practical value.

2 The establishment of index system

The dynamic assessment based on the studies and analyses of properties coordinates is defined as: if a property increases by time changing, the property is from the original $x_1,\cdots,x_n$ to $x_1,x_2,\cdots,x_n,x_{n+1}$, and thus $x = x(t) = (x_1(t), x_2(t),\cdots,x_n(t),x_{n+1}(t))$, $w = w(t) = (w_1(t),w_2(t),\cdots,w_n(t),w_{n+1}(t))$, we can find a new standard point by the new values of attributes and the weight, and then get the overall satisfaction and sort with all teachers.

We can do a comprehensive assessment in three attributes, teaching evaluation score by students, peer teachers and the mean increment of student achievement, the idea of assessment is: For three attributes (student ratings, teacher ratings, mean incremental of student score), the first semester score: (x_1, y_1, z_1), at this time, z_1 is 0, that is equivalent of the assessment deciding by only two properties, according to the evaluation model[4~7]. Professor Feng Jiali described later and Shen Jiahua teacher's improved algorithm of concentric, a ranking of teachers can be drawn. As time goes on, the second semester score is(x_2, y_2, z_2), at this time the assessment is related to ratings on the three attributes and then get a rank, the rank at this time may occur inconsistency with the last semester, and this is a non - monotonic[3] mentioned in artificial intelligence, and the final ranking is the ranking of the second semester.

Indicator system[5,8] of teaching quality assessment can be considered from chart 1 (three indicators).

3 The introduction of evaluation model

The calculation steps about the evaluate model[9,10] of attribute theory methods are as follows:

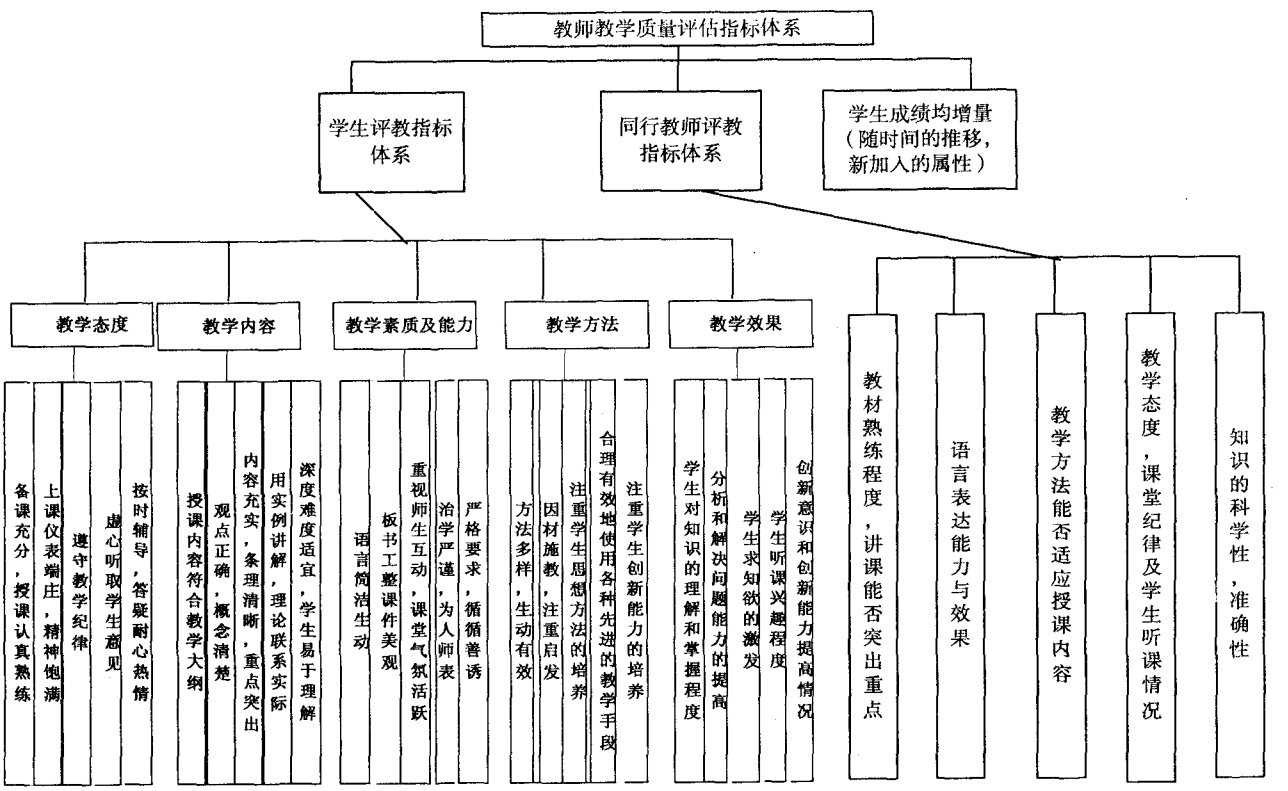

Chart 1　Indicator system of teaching quality evaluation

(1)Make sure of all the factors affecting the evaluation of teaching quality, building up a comprehensive evaluation index system.

(2)Apply qualitative mapping function[11,12] to unite non-linearly the attribute utility values:

$$\mathrm{sat}(x_i, x^*(z)) = \exp\left\{-\frac{\sum_{j=1}^{m} w_i \mid w_{ij} - x_j^*(z) \mid}{\sum_{j=1}^{m} w_j \delta_j}\right\} \tag{1}$$

In the formula, $\delta i = \delta i(z)$ refers to the deviation of the ithand z_i, which evaluator holds for the index z, and $w_j = w_j(x_j^*(z), \delta_j)$

(3)Make sure of the local most satisfactory solution. Let T_0 be the critical sum grade, between $(T_0, 100n)$, select several points equably in terms of curve simulation: $T_1, T_2, \cdots, T_{n-1}$ are several samples chosen on the points with a full grade $T_i (i = 1, 2, 3, \cdots, n-1)$ for the study, and then the local most satisfactory solution is secured according to equation(2).

$$b(\{x^h(z)\}) = \left[\frac{\sum_{k=1}^{t} v^k x_1^k}{\sum_{k=1}^{t} v^k}, \cdots, \frac{\sum_{k=1}^{t} v^k x_n^k}{\sum_{k=1}^{t} v^k}\right] \tag{2}$$

Here, $b(\{x^h(z)\})$ is the gravity point of $x^h(z)$, $\{x_k, k = 1, \cdots, s\} \subseteq S_T$, EX the set of sample solutions x_i with a full grade T. An evaluator z could select from $\{x_k\}$ and get t sets of solutions $\{x^h, h = 1, \cdots, t\}$, to his preference and score respectively as $v^h x^h$, $v^h x^h$ is the result of weighted average method.

(4) Make sure of the psychological standard curve. By using interpolation formula, $G_j(T) = a_{0j} + a_{1j}T + a_{2j}T^2 + \cdots + a_{n+1j}T^{n+1}$, we can find the mind line $L(b(\{x^h(z)\}))$.

(5) Calculate the global satisfactory degrees of all teachers and sort them out in descending order to get the most satisfactory solution.

$$\mathrm{sat}(x, z) = \left(\frac{\sum_{j=1}^{m} x_{ij}}{\sum_{j=1}^{m} x_j}\right)^{\left(\frac{\sum_{j=1}^{m} x_j}{2\sum_{j=1}^{m} x_{ij}}\right)} \times \exp\left\{-\frac{\sum_{j=1}^{m} w_j \mid x_j - b(x^h(z_i)) \mid}{\sum_{j=1}^{m} w_j \delta_j}\right\} \tag{3}$$

Here: $\sum_{j=1}^{m} x_j$ is the sum of all attribute values of x_j, reaching full grade respectively, which equals $100n$, $\sum_{j=1}^{m} x_{ij}$ is the sum of all the attribute values x_{ij} of the solution x_j.

(6) The result of (5), i. e. , the global satisfactory degree calculated through (3), represents a 85%, soundness when subjected to further rationality verification. A weight modification formula(4)is worked out and 90% rationality soundness is achieved, which is shown as below:

$$a * \left(\frac{\sum_{j=1}^{m} x_{ij}}{\sum_{j=1}^{m} x_j}\right)^{\left(\frac{\sum_{j=1}^{m} x_j}{2\sum_{j=1}^{m} x_{ij}}\right)} \tag{4}$$

4 Concentric circle improvement algorithm

The quality of the psychological criteria for the above points obtained will be simple in this grade, if the distance on the standard point of psychological from these points is the same, we can consider these points as the composition of a concentric circles, for the above algorithm the distance is the same as that obtained from the same satisfaction, but to the problem which satisfaction with response to these points degree is difficult to sort, Shen Jiahua teacher made this improved model. The specific process is as chart 2.

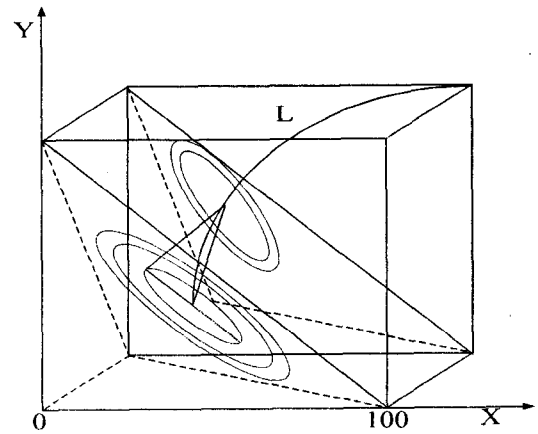

Chart 2 the concentric circle and standard curve in the level of local satisfactory degree

To simplify the explanation, removed 100 and 100 + Δα the two simple types from above the total Cartesian coordinate system, L for mental standard curve(see chart 3).

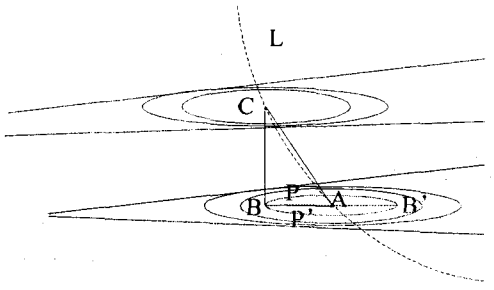

Chart 3　the concentric circle plane graph in the level

(1) Make the tangent of the standard curve(because the simple types which total scores equal to 100 and 100 + $\Delta\alpha$ are quite closely, we can approximately believe that AC is the required tangent).

(2) There must be an included angle β created by AC and the simple type which total score equals to 100, rotate vector AC ,and get min β.

(3) At this point, point of intersection B of projection of the AC on the simple type which total score equals to 100, and the concentric circle is the point of highest satisfaction, while the B', point of intersection of extension line of BA and concentric circle is the point of lowest satisfaction.

(4) Concentric circles on the points can be by comparing with the cosine of the angle to AB to determine the size, the greater the cosine value, the greater the satisfaction.

5　Results and analysis

For the psychological criteria of an expert, the first semester ranked as chart 4.

For this figure, 200919 and 200918 of the two attributes (teacher ratings, student ratings) score of (83.03,33.73) and (84.04, 33.63), but the 200918 rank

第一学期评教结果查询　　学期评教结果查询

DataGrid1

教师名	课程号	学期	名次	综合满意度	成绩增量	教师评分	学生评分	教学态度	教学内容	教学能力	教学方法	教学效果
徐兵	200934	1	1	.2285		78.11	47.4	11.97	14.354	11.974	10.004	11.556
丁群	200904	1	2	.2257		83.86	41.86	14.702	10.474	8.926	10.63	10.768
刘红	200910	1	3	.2245		82.94	45.28	12.582	9.69	11.974	8.502	12.708
彭琳	200913	1	4	.2226		78.7	42.82	11.97	13.588	8.926	9.9	11.616
张琪	200927	1	5	.2198		85.07	45.21	14.702	9.12	12.21	11.908	10.324
杨晓强	200925	1	6	.2026		83.84	43.35	12.582	9.692	14.364	13.85	9.35
肖赛军	200933	1	7	.1914		83.75	43.44	11.544	11.114	9.852	8.144	14.248
杨庆妹	200940	1	8	.191		84.01	45.05	16.268	12.834	12.604	8.978	12.222
张雪芳	200930	1	9	.1821		83.72	40.92	12.582	9.854	8.966	7.82	14.006
严国驻	200937	1	10	.1798		81.98	44.28	11.426	9.854	14.004	11.774	14.248
丁力	200903	1	11	.1759		83.86	40.23	10.694	9.69	10.17	7.644	12.708
张蓉	200928	1	12	.1508		84.49	39.06	11.97	11.802	8.926	10.108	8.52
杨良燕	200938	1	13	.1543		83.87	37.3	13.69	11.472	13.18	14.686	7.49
许唐学	200936	1	14	.1542		85.07	38.82	10.762	10.534	8.38	10.108	9.348
许念亚	200935	1	15	.1439		83.11	38.58	10.762	11.802	8.966	8.85	8.962
杨柳祥	200939	1	16	.1436		81.31	40.79	10.694	9.12	10.17	7.82	10.768
吴明明	200924	1	17	.1402		78.59	36.1	14.702	9.854	8.75	11.908	8.398
高文娟	200905	1	18	.1364		83.84	40.76	10.762	9.048	9.638	8.502	9.968
张骏	200926	1	19	.1325		83.84	32.07	9.31	11.802	6.754	9.866	11.556
石飞祥	200915	1	20	.131		85.07	37.43	11.97	10.534	8.926	8.502	8.012
陈新华	200901	1	21	.1295		80.27	33.5	10.694	6.472	10.17	8.502	12.708
刘张伟	200912	1	22	.1261		82.63	33.48	10.694	8.344	8.926	11.108	8.52
唐石华	200919	1	23	.1245		83.03	33.73	9.608	8.536	10.17	11.908	9.35
唐崇芳	200918	1	24	.1199		84.04	33.63	10.762	11.114	9.652	11.908	7.296
黄士东	200906	1	25	.1186		83.6	29.08	8.522	13.588	7.094	8.728	13.296
朱兵琴	200931	1	26	.1179		84.49	27.69	7.556	8.344	7.85	11.108	10.294
李典	200907	1	27	.1165		83.87	29.57	9.31	8.344	14.364	9.972	8.398
吴薛	200932	1	28	.1088		83.54	26.18	7.808	6.746	8.75	11.908	10.768
王玉婷	200921	1	29	.1059		84.35	29.46	10.762	13.588	8.38	10.108	6.376
程贵凤	200902	1	30	.1037		82.63	31.13	9.958	8.344	8.552	11.908	8.52

Chart 4　the evaluation result of first term

第二学期评教结果查询　　学期评教结果查询

DataGrid1

教师名	课程号	学期	名次	综合满意度	成绩增量	教师评分	学生评分	教学态度	教学内容	教学能力	教学方法	教学效果
许念亚	200935	2	1	.4036	70	81.55	56.21	12.008	15.088	12.274	15.088	11.566
杨晓强	200925	2	2	.3657	67.5	84.96	52.17	10.83	15.088	11.258	15.088	10.316
杨庆妹	200940	2	3	.3547	60.75	86.42	53.73	13.592	13.396	12.68	12.998	11.098
严国驻	200937	2	4	.3244	72	83.52	47.55	11.83	11.106	8.816	13.834	12.566
张琪	200927	2	5	.3203	68	80.01	48.41	10.474	12.232	9.808	12.226	11.816
张蓉	200928	2	6	.3116	66	77.93	48.21	10.374	15.088	9.808	15.088	9.148
唐崇芳	200918	2	7	.2063	62.5	86.6	43.77	10.83	9.544	12.274	12.226	8.624
李典	200907	2	8	.2528	53	85.33	45.38	11.83	12.232	8.956	15.088	8.624
王婷	200920	2	9	.2458	62.5	83.25	39.5	11.83	12.232	8.816	10.218	11.816
苏浩	200917	2	10	.233	61.5	82.91	38	10.228	12.404	6.238	11.18	8.624
杨良燕	200938	2	11	.2316	44	84.64	49.15	12.008	12.232	12.148	12.226	10.214
肖赛军	200933	2	12	.2274	48	86.6	45.07	10.374	10.908	9.022	11.618	11.17
杨柳祥	200939	2	13	.221	62	81.55	36.6	14.204	9.544	7.818	15.088	14.88
吴达曦	200923	2	14	.2117	62.5	85.13	34.2	10.474	6.634	7.344	11.618	9.686
徐兵	200934	2	15	.2093	52	74.57	40.02	14.204	11.964	9.424	13.228	7.008
石飞祥	200915	2	16	.2042	61	81.40	34.29	11.072	9.638	7.018	11.532	7.006
吴雏凤	200922	2	17	.204	61.5	78.44	35.93	9.414	7.45	8.548	11.18	11.536
刘延汉	200911	2	18	.1987	57	82.19	33.86	10.374	6.634	8.548	10.076	8.856
张小阳	200929	2	19	.1837	52	83.4	34	14.204	9.544	14.418	9.658	9.432
张雪芳	200930	2	20	.1824	62	85.22	29.59	8.888	13.364	8.684	8.862	9.146
石玉涛	200916	2	21	.1776	63	82.91	29.27	11.072	11.224	8.17	12.226	5.142
黄士东	200906	2	22	.1756	62	86.6	28.03	11.072	8.55	7.344	10.416	5.908
丁群	200904	2	23	.1751	60	86.42	28.31	9.514	10.944	7.344	8.798	7.962
许唐学	200936	2	24	.1741	56	85.33	29.07	11.83	11.964	8.684	6.962	14.88
丁力	200903	2	25	.1731	61	83.4	28.66	6.672	11.106	7.206	11.18	11.536
王玉婷	200921	2	26	.1728	62.5	84.38	28.09	10.82	12.404	9.808	6.962	11.536
吴薛	200932	2	27	.1727	60	80.15	29.71	10.374	10.324	9.232	7.732	11.566
刘张伟	200912	2	28	.1697	58	85.49	27.93	10.374	9.798	7.206	15.088	5.142

Chart 5　the evaluation result of second term

before 200919, this is thus a result of expert psychological preferences.

The second semester is the same(see chart 5), set parameters to various teaching types of assessment, but the properties of the final change over time has become three, the ranking is considered as the ultimate ranking of the quality of teaching.

For the two students of 200939 and 200923, three attributes (mean increment, teachers score, students score) scores were (62,81.55,36.6) and (62.5,85.13, 34.2), while 200939 of the total score of these three attributes is less than the 200923, but ranked before him, it is because this expert psychological preferences, pay greater attention to students score.

We can compare the results of two semesters, to find the assessment changes f of every teacher to teach in this process so as to better incentives for teachers to improve teaching quality.

6 Comparing the results after coefficient adjustment

Through the above (4), on the basis of the experiment we found that in the psychological decision-making process of experts, when the coefficient a is 0.7, the first semester results will be more reasonable(see chart 6).

We found little change in results after modifying the coefficient, the accuracy was higher.

DataGrid1

教师名	课程号	学期	名次	综合满意度	成绩增量	教师评分	学生评分
杨皖强	200925	1	1	.1693		87.03	42.24
杨庆妹	200940	1	2	.1665		86.38	41.87
严国驻	200937	1	3	.1618		85.32	41.12
刘红	200910	1	4	.1417		85.24	37.26
张琪	200927	1	5	.1397		81.36	37.27
卢群	200904	1	6	.1343		87.68	35.47
杨柳祥	200939	1	7	.1337		84.98	35.64
丁力	200903	1	8	.1336		87.68	35.33
张蓉	200928	1	9	.1276		85.24	34.34
张聪	200926	1	10	.1276		87.83	34
张小阳	200929	1	11	.1272		86.38	34.08
肖春宏	200933	1	12	.1256		79.21	34.59
刘凤兵	200909	1	13	.1251		86.13	33.65
彭琳	200913	1	14	.1244		73.47	35.08
许唐学	200936	1	15	.1239		81.36	33.95
许令业	200935	1	16	.1227		73.41	34.73
刘张伟	200912	1	17	.1213		77.33	33.9
徐兵	200934	1	18	.1203		61.46	36.2
张言芳	200930	1	19	.1173		86.13	31.85
杨良燕	200938	1	20	.1165		81.37	32.28
李典	200907	1	21	.115		81.37	31.94
高文娟	200905	1	22	.1131		87.03	30.64
石飞祥	200915	1	23	.1129		81.36	31.45
吴明明	200924	1	24	.1107		83	30.69
吴达峰	200923	1	25	.1081		84.95	29.79
唐端芳	200918	1	26	.1045		86.46	28.69
李德民	200908	1	27	.1038		87.92	28.3
石江海	200916	1	28	.1025		80.09	29.12
程肖凤	200902	1	29	.1012		83.37	28.28
王玉婷	200921	1	30	.098		82.72	27.55
王强	200920	1	31	.0976		82.72	27.44
苏进	200917	1	32	.0951		86.38	26.2
朱兵零	200931	1	33	.0936		85.24	25.98
唐石华	200919	1	34	.0915		87.57	25.03
黄正东	200906	1	35	.0883		85.79	24.39
陈新华	200901	1	36	.088		85.19	24.42
吴肇凤	200922	1	37	.0866		68.87	27.2
刘延汉	200911	1	38	.0846		87.92	22.96
沈杨露	200914	1	39	.081		81.43	23.05
吴善	200932	1	40	.0733		73.31	22.52

Chart 6 the result of the first term after modifying the coefficient

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