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Application of An Improved Deviation Analysis of Double Mean Data in Student'S Teaching Evaluation Data

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Abstract

This paper analyzes the main problems of College Students' evaluation of teaching, and proposes a new method to analyze and process the evaluation data.

In this paper, we first use the deviation analysis of double mean data method. Through numerical examples, we find an advantage of this method that it can effectively eliminate invalid data in the teaching evaluation data, but the result has a certain deviation from the original teaching evaluation data, and can not directly reflect the specific gap between different teachers or define the maximum and minimum of the teaching evaluation score. In order to objectively reflect the effects of teachers' classroom teaching, we make a little improvement on the basis of this method in this paper, and give each student a certain weight, so as to get a more real and effective comprehensive evaluation score of each teacher. Numerical examples are given to compare the results of the two methods, and the improved method of deviation analysis of double mean data is more reasonable and effective.

Key words: Evaluation of teaching; Double mean data; Analytic method; Weight

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1. RESEARCH STATUS QUO

With the deepening of education modernization and the advancement of education reform, more and more colleges and universities begin to pay attention to students' evaluation of teachers' classroom teaching. Students' teaching evaluation data can reflect the teaching quality of the school to a certain extent, from which we can not only find some problems in teachers' teaching, but also adjust teachers' teaching appropriately through these evaluation feedback, so as to promote the teaching quality of colleges and universities and improve students' learning effect. In order to facilitate the smooth progress of students' evaluation of teaching, the network evaluation system is widely used in colleges and universities. Each university has its own system or technology in the way of processing teaching evaluation data, but it is difficult to achieve the ideal effect. Therefore, by comparing the processing methods of each school, selecting and improving an effective processing method to realize the reevaluation of teaching evaluation data is conducive to the development of teaching work in a benign direction.

The survey found that in order to make the teaching evaluation data reflect more truly the teaching situation of teachers, the processing methods of teaching evaluation data in colleges and universities are: weighted average method, ranking method, standardization method, factor analysis method, double mean data deviation method and so on. Literature (Dai, Fang, & Yang, 2015) proposes a teaching evaluation method based on the multi-attribute group decision-making model. Firstly, the information Entropy and the normal distribution function are used to define the student's credibility function, and then the weight of student evaluation is re-assigned according to the degree of reliability. Finally, the weighted arithmetic average operators is used to group the class scores. Based on the in-depth analysis of the current situation and problems of the student evaluation of teaching system

in Colleges and universities, the literature (Ai, Wang, & Guan, 2012) puts forward the idea of establishing a comparison set according to the "homogeneous curriculum" and decentralizing the organization and management of the evaluation system from the school to the College (Department). The authors design a dynamic index system suitable for the characteristics of various disciplines and majors, and give a scheme for determining the index weight (Delphi Methods, entropy method, etc). A modified evaluation model was constructed based on the standard score evaluation model. In (Chen, 2007), 3σ Principle is used to deal with the "prejudice" evaluation noise. After deleting evaluation noise, the dissertation introduces the concept of dispute degree on the basis of the discrete coefficient, and it expresses the degree of teachers' approval. It analyzes the data deleted evaluation noise and obtains each teacher ranking by using the grey relation analysis method and factor analysis method. Finally, relational grade, close grade, rank correlation coefficient are carried on to optimize between two methods. On the basis of expounding the significance of students' evaluation of teaching to promote the development of teachers, the literature (Zhao, 2006) analyzes the current practice of students' evaluation of teaching which is not conducive to the development of teachers, and recommends several practical developmental models of students' evaluation of teaching. From the perspective of psychology, cognitive dissonance theory is proposed, which can well explain the development meaning of students' evaluation of teaching. Based on the results of teaching evaluation in a university, the literature (Pan & Zeng, 2006) uses mathematical expectation, variance and standard deviation to calculate the data, and obtains a quantitative model, which makes the teaching evaluation results scientific and reasonable. The double mean deviation data analysis method is designed as a qualitative and quantitative teaching evaluation analysis method (Mei & Zhao, 2014).

After the experiment and analysis, in order to eliminate the unreliability of students' teaching evaluation data and the blindness of students' teaching evaluation, this paper selects the double mean data deviation method and further improves it.

2. PRINCIPLE OF DOUBLE MEAN DATA DEVIATION ANALYSIS METHOD

In the process of teaching, every teacher has his own teaching method and attitude, so there are some differences in teaching level and teaching quality. However, in the actual process of teaching evaluation, there are many factors that affect students' evaluation of teaching, among which the most important factor is that students do not pay attention to teaching evaluation, leading to the data inconsistent with the facts. If students are serious, objective, authentic and responsible when evaluating teaching for each teacher, each teacher's score must be different for the same student. Therefore, in order to get the data in line with the facts, this paper uses the double mean data deviation analysis method, which can not only effectively eliminate the false data of blind evaluation of teaching, but also effectively reflect the students' real evaluation of teachers. The principle is as follows (Mei & Zhao, 2014):

According to the evaluation data a_{ij} of each student $X_i(i=1,2,\cdots,n)$ to each teacher $Y_j(j=1,2,\cdots,m)$, we can calculate the average data $\overline{X}_i$ of each student X_i to all teachers Y_j, and $\overline{X}_i=\frac{1}{m}\sum_{j=1}^{m}a_j$.

Calculate the position h_{ij} of each teacher Y_j in each student's X_i mind, and $h_{ij}=a_{ij}-\overline{X}_i$, which indicates the deviation between the j th teacher's evaluation score and the i th student's average evaluation score to all the teachers who teach him.

Calculate the average data $\overline{h}_j$ of each teacher's status in the eyes of all students, and $\overline{h}_j=\frac{1}{n}\sum_{i=1}^{n}h_j$, which represents the average value of the sum of the average deviation between the evaluation scores of all students in the the j th teacher's class and each student's evaluation score to all teachers who teach him.

Analyze the data and draw the final conclusion.

3. NUMERICAL EXAMPLES

In order to reflect the maneuverability and effectiveness of this method, this paper analyzes and processes the specific evaluation data of a university. The number of students is 10 and the number of teachers evaluated is 10. The scores are as Table 1.

In the actual teaching evaluation system, there will always be different teachers selected by students, and some students will not participate in the evaluation of some teachers, so, their scores to some teachers is represented by "null" in the table.

Table 1
Student rating table (a_{ij})

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Y_1	95	90	89	95	83	95	95	90	95	85
Y_2	88	86	95	75	95	95	95	95	95	93
Y_3	95	95	91	82	95	95	90	84	95	null
Y_4	95	80	88	95	95	95	87	null	95	78
Y_5	90	null	89	95	92	95	75	80	95	82
Y_6	93	95	85	95	null	95	92	95	95	86
Y_7	85	89	90	70	95	95	null	95	95	95
Y_8	87	91	95	null	95	95	91	90	95	95
Y_9	90	88	95	95	95	95	82	89	95	90
Y_{10}	95	93	95	95	95	95	90	91	95	90

Step 1: calculate the average data ($\overline{X}_i$) of the i th student's evaluation to all teachers.

Table 2
Student's average score table ($\overline{X}_i$)

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Y_1	95	90	89	95	83	95	95	90	95	85
Y_2	88	86	95	75	95	95	95	95	95	93
Y_3	95	95	91	82	95	95	90	84	95	null
Y_4	95	80	88	95	95	95	87	null	95	78
Y_5	90	null	89	95	92	95	75	80	95	82
Y_6	93	95	85	95	null	95	92	95	95	86
Y_7	85	89	90	70	95	95	null	95	95	95
Y_8	87	91	95	null	95	95	91	90	95	95
Y_9	90	88	95	95	95	95	82	89	95	90
Y_{10}	95	93	95	95	95	95	90	91	95	90
$\overline{X}_i$	91.3	89.67	91.2	88.56	93.33	95	88.56	89.89	95	88.22

Step 2: Calculate the position (h_{ij}) of the j th teacher in the mind of the i th student.

Table 3
Teacher status table (h_{ij})

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Y_1	3.7	0.33	-2.2	6.44	-10.33	0	6.44	0.11	0	-3.22
Y_2	-3.3	-3.67	3.8	-13.56	1.67	0	6.44	5.11	0	4.78
Y_3	3.7	5.33	-0.2	-6.56	1.67	0	1.44	-5.89	0	null
Y_4	3.7	-9.67	-3.2	6.44	1.67	0	-1.56	null	0	-10.22
Y_5	-1.3	null	-2.2	6.44	-1.33	0	-13.56	-9.89	0	-6.22
Y_6	1.7	5.33	-6.2	6.44	null	0	3.44	5.11	0	-2.22
Y_7	-6.3	-0.67	-1.2	-18.56	1.67	0	null	5.11	0	6.78
Y_8	-4.3	1.33	3.8	null	1.67	0	2.44	0.11	0	6.78
Y_9	-1.3	-1.67	3.8	6.44	1.67	0	-6.56	-0.89	0	1.78
Y_{10}	3.7	3.33	3.8	6.44	1.67	0	1.44	1.11	0	1.78

From Table 3, it can be seen that all the teachers of the 6th and 9th students have zero status in their mind, which shows the blindness of these two students in evaluating. It shows that this method can effectively eliminate the data of blind evaluation.

Step 2: Calculate the average value ($\overline{h}_j$) of the j th teacher's position among all the students.

Table 4
Average value of teacher status table ($\overline{h}_j$)

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	$\overline{h}_j$
Y_1	3.7	0.33	-2.2	6.44	-10.33	0	6.44	0.11	0	-3.22	0.13
Y_2	-3.3	-3.67	3.8	-13.56	1.67	0	6.44	5.11	0	4.78	0.13
Y_3	3.7	5.33	-0.2	-6.56	1.67	0	1.44	-5.89	0	null	-0.06
Y_4	3.7	-9.67	-3.2	6.44	1.67	0	-1.56	null	0	-10.22	-1.43
Y_5	-1.3	null	-2.2	6.44	-1.33	0	-13.56	-9.89	0	-6.22	-3.12
Y_6	1.7	5.33	-6.2	6.44	null	0	3.44	5.11	0	-2.22	1.51
Y_7	-6.3	-0.67	-1.2	-18.56	1.67	0	null	5.11	0	6.78	-1.46
Y_8	-4.3	1.33	3.8	null	1.67	0	2.44	0.11	0	6.78	1.31
Y_9	-1.3	-1.67	3.8	6.44	1.67	0	-6.56	-0.89	0	1.78	0.33
Y_{10}	3.7	3.33	3.8	6.44	1.67	0	1.44	1.11	0	1.78	2.33

From the last column of Table 4, it can be seen that the average value of each teacher's position in the mind of all students is positive or negative. The higher the value, the higher the teacher's position in the mind of the students. Thus, the teaching quality of the teacher can be reflected from the side.From Table 4, we can see that the Y_{10} teacher has the highest status in the students' mind, and the Y_5 teacher has the lowest status in the students' mind.

The scores ranged from high to low: $Y_{10} > Y_6 > Y_8 > Y_9 > Y_1 > Y_2 > Y_3 > Y_4 > Y_7 > Y_5$.

However, there are some drawbacks in the analysis of the method. The results can not directly reflect the difference between each teacher and other teachers, and the method can not define the maximum and minimum of the score. Therefore, in order to avoid this situation, this paper proposes the following deviation analysis of double mean data.

4. TEACHING EVALUATION METHOD BASED ON DOUBLE MEAN DATA DEVIATION WEIGHT METHOD

From the results of steps 1 and 2, proceed as follows.

Step 4: Give each student a certain weight, and its weight coefficient definition is $w_{ij} = \dfrac{\left|h_{ij}\right|}{\sum_{i=1}^{n}\left|h_{ij}\right|}$.

Table 5
Absolute value of teacher status table ($\left|h_{ij}\right|$)

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	$\sum_{i=1}^{n}\left\|h_{ij}\right\|$
Y_1	3.7	0.33	2.2	6.44	10.33	0	6.44	0.11	0	3.22	32.77
Y_2	3.3	3.67	3.8	13.56	1.67	0	6.44	5.11	0	4.78	42.33
Y_3	3.7	5.33	0.2	6.56	1.67	0	1.44	5.89	0	null	24.79
Y_4	3.7	9.67	3.2	6.44	1.67	0	1.56	null	0	10.22	36.46
Y_5	1.3	null	2.2	6.44	1.33	0	13.56	9.89	0	6.22	40.94
Y_6	1.7	5.33	6.2	6.44	null	0	3.44	5.11	0	2.22	30.44
Y_7	6.3	0.67	1.2	18.56	1.67	0	null	5.11	0	6.78	40.29
Y_8	4.3	1.33	3.8	null	1.67	0	2.44	0.11	0	6.78	20.43
Y_9	1.3	1.67	3.8	6.44	1.67	0	6.56	0.89	0	1.78	24.11
Y_{10}	3.7	3.33	3.8	6.44	1.67	0	1.44	1.11	0	1.78	23.27

Table 6
Weight coefficient table (w_{ij})

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Y_1	0.11	0.01	0.07	0.20	0.32	0.00	0.20	0.00	0.00	0.10
Y_2	0.08	0.09	0.09	0.32	0.04	0.00	0.15	0.12	0.00	0.11
Y_3	0.15	0.22	0.01	0.26	0.07	0.00	0.06	0.24	0.00	null
Y_4	0.10	0.27	0.09	0.18	0.05	0.00	0.04	null	0.00	0.28
Y_5	0.03	null	0.05	0.16	0.03	0.00	0.33	0.24	0.00	0.15
Y_6	0.06	0.18	0.20	0.21	null	0.00	0.11	0.17	0.00	0.07
Y_7	0.16	0.02	0.03	0.46	0.04	0.00	null	0.13	0.00	0.17
Y_8	0.21	0.07	0.19	null	0.08	0.00	0.12	0.01	0.00	0.33
Y_9	0.05	0.07	0.16	0.27	0.07	0.00	0.27	0.04	0.00	0.07
Y_{10}	0.16	0.14	0.16	0.28	0.07	0.00	0.06	0.05	0.00	0.08

Step 5: Calculate each teacher's comprehensive evaluation value $S_j = \sum_{i=1}^{n} a_{ij} \square w_{ij}$ and get the final score of each teacher.

Table 7
Teachers' comprehensive score table (S_j)

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	S_j
Y_1	10.73	0.91	5.97	18.67	26.16	0.00	18.67	0.30	0.00	8.35	89.76
Y_2	6.86	7.46	8.53	24.03	3.75	0.00	14.45	11.47	0.00	10.50	87.04
Y_3	14.18	20.43	0.73	21.70	6.40	0.00	5.23	19.96	0.00	null	88.62
Y_4	9.64	21.22	7.72	16.78	4.35	0.00	3.72	null	0.00	21.86	85.30
Y_5	2.86	null	4.78	14.94	2.99	0.00	24.84	19.33	0.00	12.46	82.20
Y_6	5.19	16.63	17.31	20.10	null	0.00	10.40	15.95	0.00	6.27	91.86
Y_7	13.29	1.48	2.68	32.25	3.94	0.00	null	12.05	0.00	15.99	81.67
Y_8	18.31	5.92	17.67	null	7.77	0.00	10.87	0.48	0.00	31.53	92.55
Y_9	4.85	6.10	14.97	25.38	6.58	0.00	22.31	3.29	0.00	6.64	90.12
Y_{10}	15.11	13.31	15.51	26.29	6.82	0.00	5.57	4.34	0.00	6.88	93.83

In Table 7, the last column represents the final evaluation value of each teacher calculated by using the improved deviation analysis of double mean data in steps 4 and 5. From the results, it is not difficult to find that the Y_{10} teacher has the highest status in the hearts of students, while the Y_7 teacher has the lowest status in the hearts of students. The scores ranged from high to low: $Y_{10} > Y_8 > Y_6 > Y_9 > Y_1 > Y_3 > Y_2 > Y_4 > Y_5 > Y_7$.

5. COMPARISON AND ANALYSIS

According to the conclusions in Table 4 and Table 7, we can see that there are some differences in the results. By comparing with the original data in Table 1, we can find that the conclusion in Table 7 is more consistent with the facts. Because in the original data table 1, all students' scores of the last teacher are above 90 points, which shows all students' approval of the teacher, and reflects the teacher's high teaching quality and student satisfaction, however, for the 7th Teacher, there are some students with low scores, which indicates that a small number of students have their own opinions or suggestions on the teacher's teaching level or other aspects. It can be seen that there is a certain deviation between the results obtained by the original deviation analysis method of double mean data and the facts reflected in the original teaching evaluation data, on this basis, the idea of giving weight to each student proposed in this paper can reflect each teacher's teaching effect truly and accurately.

CONCLUSION

Based on the application of double mean data deviation analysis in processing of teaching and evaluation data,

this paper puts forward an improved method, which grants each student a certain weight, so as to attain the comprehensive evaluation score more accurately from each teacher. Through comparison, it is found that there is a certain error between the conclusion of the original method and the information reflected in the original teaching evaluation data, while the improved method shows more effective and reasonable, and its conclusion is more in compliance with the true facts. This method not only effectively uses the advantages of the double mean data deviation analysis to eliminate invalid data, but also breaks through the shortcomings of existing deviation due to the variance between the conclusion draw by original method and the actual data. At the same time, it can also reflect the gap of each teacher's comprehensive score of teaching evaluation, which reflects the effectiveness of the improvement based on the original method, and also reflects the feasibility of the application of this method to online teaching evaluation in colleges and universities.

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