Correlation Analysis of Lessons Evaluation Based on K-Cluster Machine Learning

Linna Li[1], Cherry Jiang[2], Jiangyi Lv[3] and Zhiwang Gan[4]

[1] Nanjing University, Nanjing, Jiangsu, China
[2] Columbia University, New York, USA
[3] Beijing Polytechnic, Beijing, China
[4] Tianjin Peisheng EDU Tech. Co. Ltd, Tianjin, China

Abstract: This paper analyzes and describes the concept and function of classroom teaching supervision in higher vocational colleges through the example of data collection of classroom teaching supervision in higherational colleges. And analyzes the composition of teaching supervision personnel and the operation of the supervision system. Moreover, it explores the dimension and index of the teaching quality evaluation in higher voc colleges. It describes them from the aspects of teaching evaluation mode and teaching evaluation dimension. It also classifies and studies the teaching evaluation from the main body of teaching activities. That is the teacher, and the teaching evaluation from the teaching process. According to the two types of data derived by the student evaluation system, one is the relatively complete total evaluation scores of lessons evaluation data, and the objective correlation and clustering analysis of PCA (principal component analysis) dimension reduction. K-cluster (K-means) analyzed the classification of the total score, and analyzed the random forest method (Random-Forest). The lessons evaluation data is divided into multiple related dimensions, and the actual contribution to the total score difference, colleges and universities establish the better main factors to improve the participation of the corresponding reliability. It is suggested that vocational colleges should select and employ professional personnel and set up specialized agencies to be responsible. For the effective substantive operation of teaching supervision, so to realize the integration of supervision, evaluation and guidance. In addition, teaching evaluation should present diversification in terms of evaluation methods, evaluation and evaluation standards. Describe and evaluate the teaching process of teachers as truly, objectively and scientifically as possible, so as to provide specific and constructive references for improving teaching.

Keywords: data cleaning; time dimension; K-cluster; random forest

1. Introduction

Student education evaluation means that, according to certain standards, by using certain techniques and methods, the value judgment of taking the teaching quality of teachers as the evaluation object. It is one of the important areas of educational evaluation. It is also a focus of attention in school education. Generally, according to the teaching attitude of the class teacher. Teaching organization and arrangement, teaching efficiency, language performance, Scientific nature and blackboard writing, teaching manners, Status of correcting work, quantity of work. To evaluate [1] on Counseling, Give each corresponding item the common usage grade of score c, Or a 100-point system. For example, "Excellent", "good people", "centre", More than 90 points in the 100 percent system means excellent. A score of 80 indicates a good, 70 And above are basically qualified, 60 Is it unqualified. The analysis and summary of student evaluation data is conducive to reflecting students 'acceptance of teaching mode, reflecting the people-oriented concept, promoting teachers' service consciousness, harmonizing the relationship between teachers and students, and can be more scientifically and systematically used to guide the iteration and upgrading of teaching mode, which is the method and practice of innovative mode. But because each school has different ways of collecting data methods, collected data is not comprehensive is not objective problem, the data and the real value has certain deviation, evaluation has certain subjectivity [2].Overall, the small error is reasonable, fault-tolerant, and does not affect the overall validity and reliability of the analysis. But due to the complexity of the evaluation index and index uncertainty, will let a lot of students are not very active participation. Participation is not high, at the same time prone to perfunctory attitude [3].

2. Data Analysis

This data is obtained from the academic evaluation system of Beijing Vocational Information Technology College. This data contains the overall evaluation data of each semester since 2021. By the student evaluation, peer mutual evaluation, supervision group scoring three ways [4]. The total score is a weighted sum of these three ways. The weight is: 40% of student evaluation, Peer: 30%, Supervision group 30% and student evaluation 40%, Peer: 40%, With 20% of the weight combination. Also contains student evaluation data for the two semesters of the academic year. It cotains the title of teachers, The

affiliated college, Type of college affiliated, Ranking of the affiliated colleges, School-wide ranking [5]. And the

12 sub-scores of student evaluation, as shown in Table 1 below:

Table 1. The 12 scoring indicators of student evaluation.

1	I think teachers can strictly manage, teachers and students communicate harmoniously, and the learning atmosphere is harmonious.
2	Board writing teaching AIDS, media courseware, practical training equipment, experimental materials and other fully prepared, flexible and skilled use.
3	The learning task assigned by the teacher is clear, and I can understand and master it.
4	Teachers moral noble, the spread of positive energy, can become my dedication to the motherland guide; care for students, Service to the students, kind and natural.
5	I like the teacher's teaching method, which can inspire my thinking, guide and guide me to study.
6	I have mastered the course content and school methods, improved my skills and interest in learning, and gained a lot from learning.
7	The teacher can be strict with the law, do not be late, do not leave early, do not miss classes, suspend classes, do not answer the mobile phone, Can teach by words and deeds.
8	The teacher is full of spirit, clear organization, concise language, the combination of speech and practice, operation demonstration in place.
9	The teacher's knowledge, solid, classroom teaching content, rich examples, I am very interested in learning, Can be a leader in my learning knowledge.
10	Teachers pay attention to the cultivation of innovation ability, and can become a guide to my innovative thinking, I have learned a lot of analysis. Problems and problem solutions.
11	The teacher taught me how to do things, good at discovering my advantages, timely encouragement, enhance my confidence in learning.
12	The teacher assigned the right amount of homework, timely and serious, I can get the teacher's guidance and help after class.

Several problems can be found after the source and collation of the evaluation and analysis data: Clean the data from the year data, and we have found that the annual number of participating teachers is about 300-550, including the professional title of the teacher, the college, the college type, the total evaluation score, the total student evaluation score, the peer evaluation scores, the supervision group evaluation scores, and these four types of scores [6].

In order to verify the persistence and stability of the teaching level in the time dimension of the same teacher, all the annual corresponding scores and the serial number of the teacher are made as the basis, and the data of the complete continuous information, including the time, professional title and the total score of the annual teaching evaluation are sorted out and cleaned, and there are finally 224 continuous and effective data [7].

2.1 DA Trend Analysis of the Complete Data over the Years

To analyze the school student evaluation data, it can be divided into four categories. For the primary, intermediate, deputy senior, senior, totally four levels. Distribution is shown in Figure 1. The total score of the corresponding semester can be seen according to the ranking of professional titles [8]. The trend of levels over time basically has some consistency, The distribution and relationship of the corresponding total scores and average scores of different professional titles are shown in Figure 2. The corresponding trend diagram is shown in Figure 3:
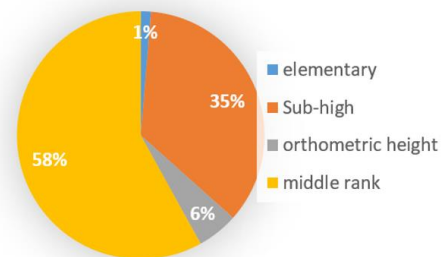

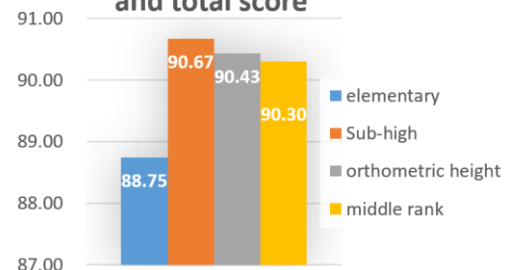**Figure1.** Distribution of teacher professional titles participating in the analysis.

Figure 2. Distribution and relationships corresponding to the total and mean scores of different professional titles.
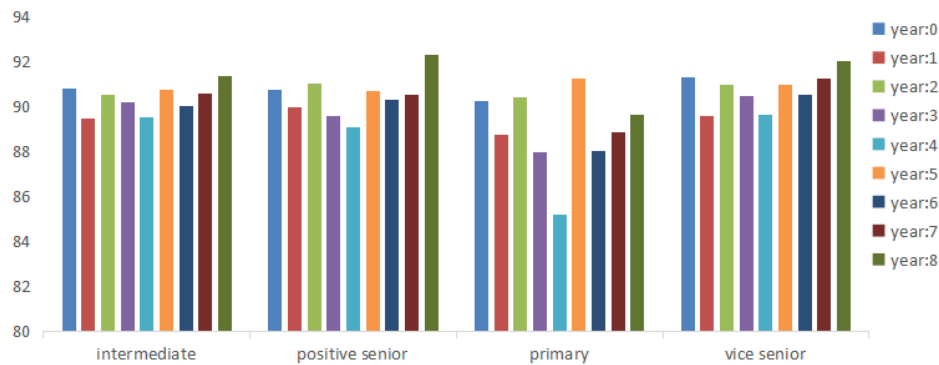
Figure 3. Average relationship between calendar years of total scores of different professional titles.

It can be seen that the scores of peers and supervision group are generally lower than those of students, namely, peer 85.34-89.1, supervision group 83.91-84.58, and student evaluation is 94.81-95.53. Overall, according to the professional title category, peers and supervision groups score slightly higher on the higher level, and the lower level is also lower, indicating that there is a certain tendency [9]. And students score, for the number of teachers scores are relatively higher, primary because the number is less, statistical tendency is not clear enough, will be in the following chapter detailed analysis. In general, the teams and peer scoring has certain and title is proportional to the orientation, the highest vice high, the relatively higher scores, students' scores and title correlation is slightly lower, and the number of teachers [10].

It can be seen that the corresponding clustering results and the overall score of the academic evaluation are basically positively correlated, divided into four categories, and the corresponding overall score value is a linear differentiation, as shown in Figure 4.
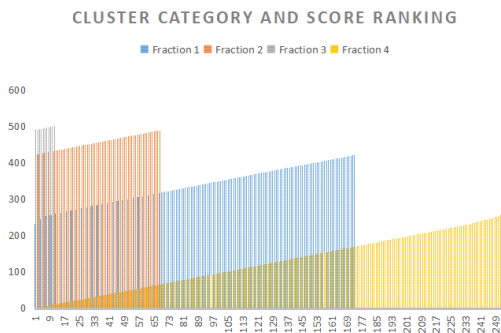

Figure 4. Cluster categories and total score rankings are represented as fractional segment correlations.

2.2 Reliability Analysis of Student Evaluation Participation Rate and Evaluation Scores

Based on the principles of statistical sampling, the larger the range of the sampled data distribution. The greater the amount of participation, the more accurate [11] of the experiment. Student education evaluation data also follow this principle. Too little participation rate reflects

some sample insufficiency and bias. For different professional titles, the two groups with the largest numbers were selected for analysis. Figure 5 shows the relationship between the overall participation rate and the fractional segment. The participation rate here is divided into several levels: 0, 20, 50, 100, 150, 200, 250, 300, 350, 400.The corresponding number of participants, respectively, within 20, 20-50, 50-100, 100-150, 150-200, 200-250, 250-300, 300-350, 350-400, At least 400 +.
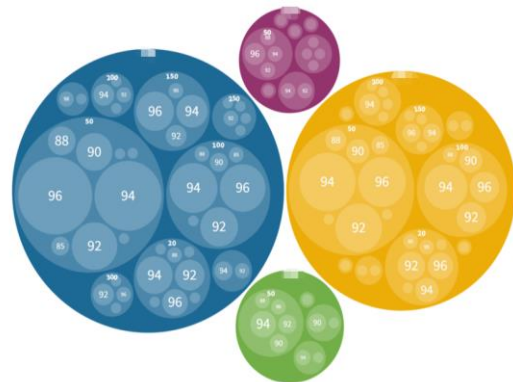

Figure 5. The Relationship between the overall participation rate and the fractional segments.

2.3 Students Evaluate the Contribution Rate of Multidimensional Characteristics

The 12 scoring indicators of student ratings are shown in Table 1 above. To explore the metrics for simplified scoring, focusing on several indicators that contribute the most to the overall score. The results after clustering in the previous section can be used as a label for the classification of the analysis data. The method employed is that the random forest acts as a classifier. In contrast to the other algorithms, random forest algorithm has high accuracy. Tolerable noise strength [12], at the same time, the contribution of the relevant index to the overall classification result [13], corresponding 12 features, the total contribution ratio of the top 7 contributors accounted for more than 80%. Corresponding to number 9 in Table 1, 5,4, 10, 8,11, 3 feature. Approach the teacher's knowledge, solid, classroom teaching content,

rich examples, have a great interest in learning. Can be a leader in my learning knowledge. Like the teacher's teaching method, which can inspire my thinking, guide to study. Teacher moral noble, spread positive energy, can become my dedication to the motherland guide. Care for students, Service to the students, kind and natural. Teachers pay attention to the cultivation of innovation ability, and can become the guide of my innovative thinking, have learned a lot of analysis.

3. Corrective Actions and Conclusion

Due to issues with the integrity of the data collection, other directions of analysis that could be explored were influenced by this factor. For example, the annual data of the student evaluation data is not complete. Can increase the corresponding amount of the collection year by year. More step to determining the direction of the analysis and the corresponding correlation. The research significance of this paper is also to improve the corresponding role of students' professional title evaluation.

In order to increase the reliability of students' evaluation data, according to the analysis of the above section, increase the students' participation rate, in addition to the students' subjective willingness to participate in itself, can reduce the difficulty of statistics and collection. Such as simplified scoring characteristics, can promote more students to participate in the score, the data will have less deviation. Through this analysis, it can be seen that peers and supervision groups will have a certain prior tendency to score, and a certain tendency to score according to the existing teacher title. This factor can be considered how to improve. The number of students' evaluation characteristics can also be reduced and adjusted according to this article according to the contribution of this article.

References

[1] Rui Gao, Zhiwang Gan, Cherry Jiang. Correlation Analysis of Vocational College Teaching Psychological Evaluation System based on PCA, International Journal of Mental Health Nursing, 2024, 33(3): 5-6.

[2] Wang Zhengqiang. Sampling error analysis. Measurement and Testing technology, 2005, 32 (1): 2.

[3] Zhang Ying, Gao Qianqian. Chaohu Lake Water Quality Evaluation based on the Random Forest classification algorithm. Environmental Engineering Journal, 2016, 10 (2): 7.

[4] Zhang Peng, Dong Yuxuan. Research on the Application of Intelligent Three-dimensional Stereo Evaluation in the Evaluation of Classroom Teaching Effectiveness, Science and Education Journal, 2025, (06): 36-40. DOI 10.16871/j.cnki.kjwh.2025.06.008.

[5] Wang Yan Guo Aihua. Research on the Reform and Innovation of Classroom Teaching Based on "Outcome-Oriented, Integration of Morality and Skills, and Multidimensional" - Taking the "JSP Application Development" Course as an Example. Education and Information Technology, 2025, (03): 6568 73.

[6] Gao Bo. Research on the Evaluation of Teaching Quality in Higher Education Based on the Integration of Multiple Theories, Window (Teacher Edition), 2025, (02): 16-18.

[7] Qin Lijun, Qin Shanghe, Liu Ting. Improving Teaching Quality - Research on "Transforming Higher Education: Multidimensional Teaching Evaluation", World Education Information, 224, 37(10): 40-47.

[8] Liu Min. Exploration of Practical Strategies for Teaching Evaluation in Higher Education the Era of Artificial Intelligence, Xue Zhou Kan, 2024, (28): 122-125. DOI 10.16657/j.cnki.issn1673-9132.2024.28.03.

[9] Huang Guanli, Dong Yige, Qi Zhiming, et al. Analysis of the Impact of Individual Psychological Characteristics and Upbringing Patterns of Vocational College Students on Internet Addiction Behavior, Journal of Mental Health, 2009, 22(03 163-166.

[10] Liu Min. Exploration of Practical Strategies for Teaching Evaluation in Higher Education in the Era of Artificial Intelligence, Xue Zhou Kan, 2024, (28): 122-125. DOI: 10.1667/j.cnki.issn1673-9132.2024.28.031.

[11] Qi Yishan, Huang Guanli. Design and Analysis of Construction Plan for Classroom Teaching Data Resources in Vocational Education, Modern Vocational Education, 2023, (25): 153-156.

[12] Huang Guanli, Liu Ling, Yang P, et al. Compilation and Reliability and Validity Inspection of Psychological Quality Scale for Teachers in Vocational Colleges, Journal of Mental Health, 2014, 27(06): 401-404.

[13] Huang Guanli, Qi Yishan Bai Nan, et al. Review of Supervision and Evaluation of Higher Vocational Education Teaching under the Perspective of International Comparison, Journal of Higher Education, 2024, 10(25): 95-98. DOI: 10.19980/j.CN2-1593/G4.2024.25.022.