Analysis on teacher teaching evaluation system based on clustering constant modulus

Jiangyi Lv[1] , *Cherry* Jiang[2,*], and *Zhiwang* Gan[3]

[1]Beijing Polytechnic, Beijing, P.R. China
[2]Stony Brook University, Suny, Stony Brook, NY, U.S.A.
[3]Tianjin Peisheng Education Technology Development Co., Tianjin, P.R. China

Abstract. It is compiled by referring to some dimensions of cartel 16 personality factors questionnaire (16PF) and combined with the current situation of teachers in vocational colleges. Six dimensions are designed, which are communication and expression, innovation, persistence, manual operation, teachers' professional identity and intelligence. The clustering algorithm is used to simulate and analyze the data system and establish the big data norm. In addition to describing the whole from the data of centralized trend and discrete trend, it can also describe the position of each individual score in the whole. Here, the concept of overall distribution is used to describe the overall data state by presenting the distribution diagram.

Keywords: Clustering algorithm, Teaching evaluation, Norm analysis, Cartel personality factor.

1 Measurement tool and dimension design

The measurement tool used in this survey is based on the results of the previous interviews, and uses the 16 personality factors questionnaire (16PF) for reference, it is compiled according to the current situation of teachers'psychological quality in vocational colleges. The questionnaire items were first compiled by graduate students in the Clinical Psychology Department of the Peking University Health Science Center, and then evaluated by an expert group. The questionnaire items were screened .through two aspects: Statistical indicators and actual utility indicators. Finally, six dimensions were obtained, questionnaire with 60 entries.This questionnaire is mainly used to measure the psychological quality and teaching quality of teachers in vocational colleges, which can be effectively measured in recruitment, evaluation and assessment.In order to demonstrate the reliability and validity of the questionnaire, the concepts of reliability and validity of psychometrics are used.Reliability refers to the consistency, stability and reliability of test results, which is usually expressed by internal consistency. In general, reliability is expressed in terms of R, and the value of reliability is usually between 0 and 1. The higher the reliability coefficient, the more consistent, stable and reliable the result of the

---

* Corresponding author: cherryhenry@163.com

test.Reliability mainly refers to the reliability, consistency and stability of the test results, that is, whether the test results reflect the stability and consistency of the real characteristics of the tested. A concept related to reliability is validity, and reliability is the precondition of validity.The reliability is only affected by the random error. The larger the random error, the lower the reliability. Therefore, the reliability can be regarded as the degree to which the test results are affected by random errors. The system error has a constant effect and does not affect the reliability. The actual score (x) for each test is always made up of the true score (t) and the error (e) , expressed as follows,$X=T+E$.If we discuss the characteristics of a set of test scores, we can use variance to represent specific scores and get a formula: $S^2(x) =S^2(t)+S^2(e)$.In the formula, $S^2(x)$ is the variance of the real score, $S^2(t)$ is the variance of the true score, $S^2(e)$ is the variance of the error , $r(xx)=S^2(t)/S^2(x)$. Since the variance of the true score is impossible to measure, it translates into: $r(xx)=S^2(x)-S^2(e)/S^2(x)=1-S^2(e)/S^2(x)$. Therefore, reliability can also be considered as the proportion of the variance of non-measurement error in the total variance. In this study, we use the Coefficient of internal consistency, i. e. the Cronbach Coefficient. It mainly reflects the relationship between the internal items of the test, and examines whether each item of the test measures the same content or characteristics. Homogeneity reliability refers to the degree to which each item in the test has examined the same content. When homogeneity is low, even though each test seems to measure the same trait, the test is actually heterogeneous, that is, it measures more than one trait. The reliability of the total scale is, and the reliability of each dimension is validity. It refers to the degree to which a measuring instrument or means can accurately measure what is to be measured. The validity refers to the degree to which the measured results reflect the content to be examined. The more the measured results coincide with the content to be examined, the higher the validity is. Construct validity is used here to describe the validity of the questionnaire. Construct validity refers to the degree to which the test can measure the theoretical structure or trait, that is, whether the six dimensions in the questionnaire can effectively measure the psychological quality of vocational college teachers. The results of the validation of the construct validity are shown in the following figure. In this survey, a total of six dimensions were designed, namely communication and expression, innovation, perseverance, hand-operation, teachers'professional identity, wisdom. The communication and EXPRESSIVENESS DIMENSION MEASURES:the Innovation Dimension Measures,the Constancy Dimension Measures,the Manual Dimension Measures,the dimensions of teachers'professional identity were the Intelligence Dimension Measures: In this questionnaire, there are six dimensions, among which communication and expression are composed of 10 questions, creativity is composed of 10 questions, constancy is composed of 10 questions, manual operation is composed of 9 questions, and teachers'professional identity is composed of 10 questions, intelligence consists of eight questions and three lie-detector questions, which measure an individual's honesty in answering this questionnaire. The five dimensions of communication and expression, innovation, constancy, hand manipulation, and teachers'professional identity are the subjective evaluation of the self and the consistency of the subject description, which belongs to subjective evaluation scale. For example, to measure individual communication and expressiveness by rating "I like to participate in various parties and activities, and always appear active", and "WHEN traveling, I like to choose some new unexplored spots and routes, They are not willing to choose those famous scenic spots with standardized management "to measure the individual's innovation," "I often make things by myself, from which I can get great pleasure" to measure the individual's manual operation, these are all positive scoring items. In other words, the higher the score, the better the individual's performance in that dimension. At the same time, there are some items in this questionnaire that are scored in the opposite direction, For example, "I think teaching in a vocational college is tiring and

not challenging. " This item is used to measure an individual's professional identity, which means that the higher the individual's conformity on this item, it shows that the lower the individual teachers'professional identity is the sixth dimension of the questionnaire is intelligence, which is based on a number of items of aptitude tests, measured in the form of an achievement test, in which there is a correct answer to each question, an individual who chooses the correct answer gets a full mark for the question. If he does not get it right, he gets the basic mark for the question.

An example of an intelligent test question is "6 , 24 , 60 , 132 , (?) , What should be entered in () is A. 140　　B. 210　　C. 212　　D.276", In this case, the rule is to double the previous number by 12 to get the latter, so the correct answer is d. The survey was conducted by Wu Rengang, a professor in the Clinical Psychology Department at Peking University Health Science Center, who directed master's and doctoral students to collect survey data over time, in the Beijing Electronic Vocational and Technical College, with the cooperation of college leaders and teachers, completed the survey. A total of questionnaires were distributed in the survey, of which were collected, with a recovery rate of, among which, valid questionnaires were obtained, with an efficiency of. The survey covers nine colleges (departments) , including the school of Management, the school of bioengineering, the School of Telecommunications, the School of arts, the automation, the school of Automotive Engineering, the Mechanical Engineering, the Foundation Department, and the Department of Political Science, the number of participants is shown in the table below.

Table 1. A indicative scale of the number of college students surveyed.

College (Department)	Number of persons investigated
School of Economics and management	15
The bioengineering	51
School of Telecommunications	40
School of the arts	53
Automation	76
School of Automotive Engineering	65
The mechanical engineering	82
Foundation Department	64
The Ministry of the Interior	42
College not filled in	45
Total number	533

2 Tendency of concentration of psychological quality scores of teachers

2.1 Median and average scores of teachers'psychological quality

This part will introduce the basic situation of the psychological quality of the teachers in our school, and will introduce the tendency of concentration and dispersion. The tendency to concentrate refers to the area in which a trait score is concentrated in the observed sample to describe the overall situation of the group. Three basic variables are used to describe the trend of population concentration, which are mode, median and average.A mode is a value that has a statistically significant concentration of trending points on the distribution, representing the general level of the data (the mode may not exist or may be more than one) . In other words, the mode is the number that appears most often in a set of

data. It is called the mode, and sometimes there are several modes in a set. Simply put, it's the number that makes up the largest percentage of a set of data. For example, the shooter hit the target five times, the number of rings were 8,9,8,8 and 6 respectively. You can see that 8 rings got the most times, then 8 rings is the mode number in this set of data.The median, also known as the median, refers to the number in the middle of a set of data arranged in order, that is, half of the data in this set is larger than it, half the data is smaller than it. This number may be one of the numbers, or it may not be the original number at all. That is, after sorting a set of numbers, the number in the middle (the number of digits is odd) ; or the average number of the two numbers in the middle (the number of digits is even) . Using the previous example, the order of the number of rings in a shooter's five shots is from small to large: 6,8,8,8,9, then the number in the middle is the third of 8, that is to say, in this case, the median is 8 rings.An average is a quantity that represents a trend in a data set. It is an indicator of a trend in the data set. Arithmetic mean is the sum of all the data in a set of data divided by the number of data. When you divide the sum of n numbers by N, the quotient is called the arithmetic mean of n numbers. One of the obvious advantages of an average is that it can take advantage of all the characteristics of the data and is relatively easy to calculate. In addition, in mathematics, the average is the sum of the squares of the errors to reach the minimum of statistics, that is to say, the use of the average on behalf of the data, can make the secondary loss minimum. According to the above mentioned five shooting results of shooters, the average score is $(8 + 9 + 8 + 8 + 6)5 = 7.8$, that is, the average score of these five times is 7.8 rings.

Table 2. The median and average scores of the total scores and the scores of each dimension.

| Projects	Mean number	Median number	Mode number	Ten out of ten
Communication Expression Score	30.98	31.00	31	50
Innovation Score	32.52	32.00	32	50
Constancy score	32.39	32.00	34	50
Manual score	29.83	29.00	30	45
Career Identity Score	31.08	31.00	30	50
Points for intelligence	18.43	20.00	20	40
Total score	175.23	175.00	174	285

2.2 Evaluation system and the calculation formula

Discrete trend refers to the phenomenon that the observed values of a group of data with the same nature are uneven. The degree of dispersion, like the centralized trend, is an important index to describe the characteristics of a group of data. When investigating the psychological quality scores of teachers in our school, we should not only know the average scores of all teachers, but also know the distribution of all scores for reference, whether the dispersion degree is low or high.This is of great significance to evaluate the psychological quality of teachers in the whole school and the psychological quality of teachers in various colleges and departments.For example, in the previous part, we mentioned that a shooter's score of five shots was 8 rings, 9 rings, 8 rings, 8 rings and 6 rings, with an average score of 7.8 rings. The average score of another group, 10 rings, 10 rings, 4 rings and 5 rings, was also 7.8 rings. Obviously, we can see that although the average score of the two groups is 7.8 rings, it is obvious that the athletes in the first group are more stable, but the athletes in the second group can play very good results, but their performance is not stable, and there are times when lower results appear.Variance and standard deviation are usually used to

describe discrete trend. Variance is the average of the square of the difference between each data and the average.The calculation formula is:. $s^2 = \dfrac{\sum_{i=1}^{N}(X_i - \overline{X})^2}{N}$ The standard deviation is the square root of variance, and the calculation formula is: $s = \sqrt{\dfrac{\sum_{i=1}^{N}(X_i - \overline{X})^2}{N}}$. For the example given in the previous paragraph, the variance and standard deviation of the results of the two groups are calculated respectively. The variance and standard deviation of the first group are 0.96 and 0.98, and the variance and standard deviation of the second group are 7.36 and 2.71. It can be seen that the higher the dispersion of the results of the second group. For the survey results, in addition to describing the whole from the data of centralized trend and discrete trend, the overall data state can also be described by describing the position of each individual score in the whole, using the concept of overall distribution and presenting the distribution diagram.Distribution refers to the position of each individual's score in the whole. The form of distribution can be used to describe the overall situation. From the perspective of data form, distribution can be divided into discrete distribution and continuous distribution. The most common is the normal distribution. Normal distribution is a very important probability distribution of continuous random variables. Its shape is like a mountain, as shown in the figure 1. below.We can see from the figure that the abscissa represents the distribution of a fraction, while the ordinate represents the number of people who get the fraction. The standard normal distribution shows the state of high in the middle and low on both sides, that is, the largest number of people get the average score. Most people get the scores near the average score. The farther away from the average score, the fewer people get the score.The distribution of data is not necessarily standard normal distribution, sometimes in the form of positive skewness or negative skewness, as shown in the figure 2. below.
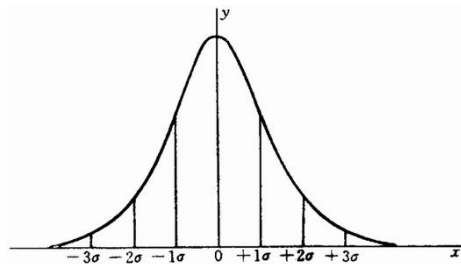
Fig. 1. Normal distribution diagram.
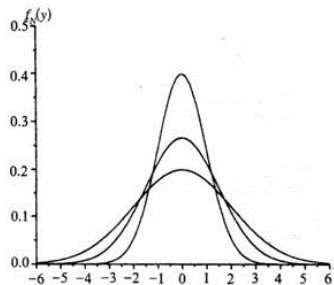
Fig. 2. Normal distribution diagram of different forms.

3 Conclusion

As can be seen from the above, in the positive skew distribution, the scores obtained by most individuals are concentrated below the average score, while in the negative skew distribution, the scores obtained by most individuals are concentrated above the average score. Therefore, through the distribution state of data, we can better understand the overall centralized trend and discrete trend of data. In addition, the steeper the distribution state, that is, the higher the peak, the faster the downhill on both sides, indicating that the distribution is more concentrated; The more gentle the distribution, that is, the lower the peak, and the slower the downhill on both sides, indicating that the distribution is more dispersed.

References

1. Trends in the reform of teacher structure and salary system in German colleges and universities [J]. Zhou Lihua. Foreign education research. 2001 (05).

2. Global competition situation and trend of scientific and technological talents [J]. Zhu junkan. Jiangnan forum. 2001 (01).

3. Abbassi Amira et al. Assessment of cylindricity and roughness tolerances of holes drilled in marble using multiple regression and artificial intelligence[J]. Advances in Mechanical Engineering, 2021, 13(8).

4. Yan LIjuan. Analysis on problems and Countermeasures of Teachers' salary and welfare in compulsory Education [J]. Time Finance,2020(17):120-121.

5. Wang Shengping, Huang Mingdong, Zhu Qiuyue. Problems and Prospects of Teacher welfare policy in China [J]. Education Review,2019(03):105-110.