

Evaluation System of College Ideological and Political Education Index Based on Data Mining Algorithm

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Abstract: The Intellectual and Political (IAP) education provided in colleges and universities is a significant component of higher education and is crucial to developing the socialist cause with Chinese characteristics and enhancing the IAP abilities of college students. The construction of college IAP education index assessment system based on multimodal learning type data mining algorithm can solve the current situation of the lack of college IAP education index assessment system. Therefore, this paper constructed an assessment system of college IAP education indicators based on data mining algorithm. It was a system that conformed to the requirements of the development of the times and the laws of education and had good human-computer interaction. Through the experiment, the comprehensive satisfaction score of the sample to the assessment system of college IAP teaching indicators based on data mining algorithm was about 4.19, and the comprehensive satisfaction score to the traditional assessment system of college IAP teaching indicators was about 2.87. The college IAP education index assessment system based on data mining algorithm was superior to the traditional college IAP education index assessment system, which made the assessment activities effectively play the role of summing up experience, learning lessons, promoting work improvement, establishing goal orientation, etc.

1. Introduction

Higher standards have been proposed in recent years for the effectiveness of IAP teachers' instruction. The current teaching assessment methods are almost always used to assess the level of teaching quality, but it is challenging to explain what variables are related to the level of teaching. More specifically, it is challenging to identify the laws related to teaching quality from the original collected data. In this paper, the teaching assessment model based on data mining was used to further effectively help teachers improve teaching quality.

Nowadays, there are some researches on the assessment of IAP teaching by scholars: Gunn, Andrew developed the indicators and methods to measure the teaching quality of higher education by formulating an excellent teaching framework [1]; Cadez, Simon studied the prominence of quality in teaching and performance assessment [2]; Grissom, Jason A conducted research on the efficiency of principals and teacher turnover in the multi-scale teacher assessment system [3]; Liu,

Guangxin, from the perspective of building a community of shared future for IAP courses, strengthened the education of IAP courses for postgraduates to strengthen the practical application of their educational theories [4]; Xiao, Shungen studied the curriculum teaching reform under the IAP education [5]. The above research has analyzed the assessment of IAP education.

Many scholars have studied data mining algorithms: Khan, Anupam explored the impact of teaching on students' performance based on data mining analysis [6]; Soroor, Shaymaa E evaluated the performance of students considering continuous courses through data mining [7]; Francis, Bindhia K used mixed data mining methods to predict students' academic performance [8]; Adekitan, Adelibigbe Israel tested the association between cognitive admission requirements and students' first-year academic performance using six data mining methods and degree grades [9]; Bharara, Sanyam used clustering data mining to analyze students' tendency [10]. The research of the above scholars has made fruitful progress in the data mining algorithm level.

The construction and implementation of the assessment index system of IAP education in Institutions of Higher Learning (IHL) cannot be perfect at one time. It is urgent to design a universal and operable assessment index system in order to achieve the purpose of exploration, summary and improvement, which can stand the test of theory and practice in practical operation.

2. Data Mining Algorithm and Multimodal Learning

(1) Overview of data mining algorithms

The application of data mining to deal with educational administration data can excavate the rules contained therein and apply them to the educational assessment system, which is conducive to the reform of education and teaching and the improvement of school running level and management level. "Knowledge" is one of the core words, and accurate understanding of the meaning of "knowledge" is the key to mastering the concept of "data mining" [11]. There are three categories of knowledge: declarative knowledge, procedural knowledge and conditional knowledge. The knowledge in the field of data mining presents a variety of meaningful data patterns rather than all kinds of knowledge in the traditional sense. There is also a one-to-one correspondence between these data patterns and data mining algorithms. In order to find useful information by using data mining technology, it is necessary to do a good job of data pre-processing and comprehensively analyze the mining results on this basis. As a complete workflow, data mining and its preparation in the previous stage and analysis in the next stage are collectively referred to as data mining projects. The implementation process of data mining projects is shown in Figure 1.

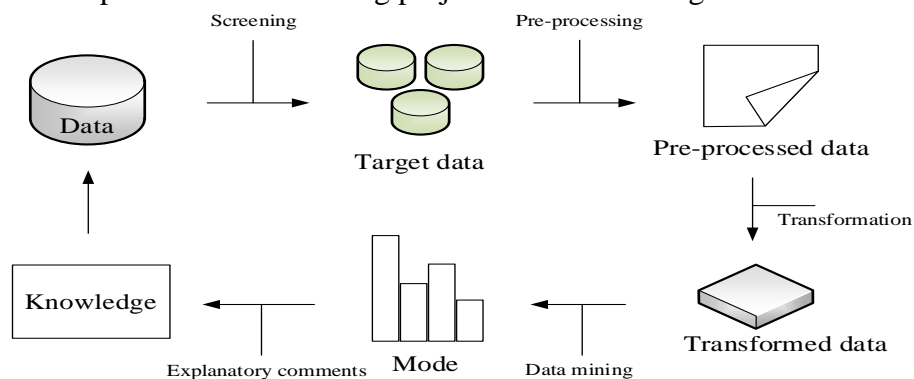


Figure 1: The process of executing a data mining project

(2) Multimodal learning

Multimodal learning has important research significance in data mining, machine learning and other related fields. Efficient multimodal learning can get richer semantic representation, and

further enhance the performance of single mode and multimodal fusion. Traditional multimodal learning methods rely on the assumption that the information of single mode itself is sufficient and the information between modes is consistent [12]. However, in practice, multimodal features generally do not meet the above assumptions. In particular, the open environment is greatly affected by characteristic noise and lack, which makes multimodal data acquisition, data representation and model output more complex. The specific performances are as follows: The collection costs of each mode are different from each other and have the characteristics of large difference in mode costs; the expression of modal data is different from each other, with the characteristics of missing modes and unclear corresponding relationship; each modal information is different from each other and has the characteristics of strong and weak modes.

The features learned from multimodal representation can be used for information retrieval, classification and regression tasks. The DBM (Deep Boltzmann Machines) structure is extended to the multimodal domain to form a Multimodal DBM, which can learn the joint probability distribution of multimodes. The structure of the Multimodal DBM is shown in Figure 2:

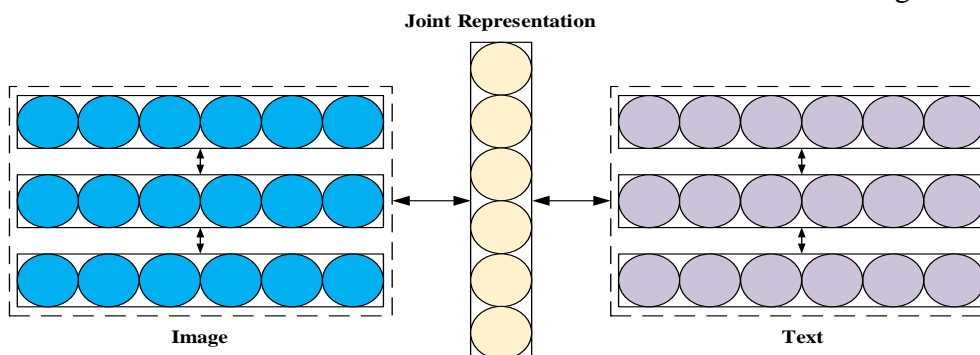


Figure 2: Multimodal DBM structure

3. IAP Courses and the Nature of Assessment

(1) Meaning and function of IAP course

As the primary platform for college students to carry out IAP education and publicize Marxist ideology, the IAP theory course in IHL helps students form a correct outlook on the world, life and values. For China's socialist construction, IAP education is an important project to shape the soul. According to the development needs of the country, the construction of IAP theory courses in IHL should be strengthened to achieve continuous development and improvement, so as to play a positive role in socialist construction.

(2) Analysis on the assessment of IAP teaching quality in IHL

1) Assessment standard for IAP teaching quality in IHL

The teaching of IAP theory in IHL should adapt to the overall development of the majority of students, which is to establish a correct world outlook, outlook on life, values and firm and correct ideals and beliefs. The specific criteria for evaluating the IAP theory course in IHL are set to evaluate the subject according to these basic criteria and in combination with specific assessment situations [13]. The development and design of the assessment index of the IAP theory course should also conform to the goal rather than the dissociative goal; the formulation of indicators must be overall and complete and can fully reproduce and reflect the educational goals; this indicator system should be consistent with the actual level of students' ideological and moral character and can be recognized and accepted by most students, which is feasible; the establishment of the indicator system should be able to obtain clear conclusions from the measurement and solve the reliability and validity problems.

At present, the assessment criteria and index system of IAP theory courses in IHL are still lack of scientificity, and the abstract training objectives are often simply regarded as assessment criteria without paying attention to the specific transition from training objectives to assessment criteria. In the process of teaching assessment research, it is necessary to evaluate from simple theoretical knowledge to theoretical level, practical ability and moral cultivation; the change from focusing on score measurement to focusing on thinking, morality and other behavior patterns and the behavior patterns it shows is to measure and emphasize the cultivation of comprehensive ability and the improvement of quality.

As the assessment of IAP theory courses in IHL involves factors, processes and educational effects of IAP theory courses, the assessment criteria should be the objective criteria for the assessment of teaching factors, processes and effects by the assessment subject [14]. Therefore, the assessment subject should mainly focus on the activity state and effect of the evaluated object. The assessment criteria set should not only include various factors in the teaching of IAP theory and the criteria to measure whether the process is standardized or not, but also include the criteria to measure the teaching effectiveness of IAP theory.

2) Assessment methods of IAP teaching quality in IHL

The establishment of the assessment index system of IAP education in IHL is participated by people, but it is not subjective fabrication [15]. The design and construction of the assessment index system of IAP education need to fully consider the needs of national and social development for IAP education in IHL, and carefully study the relevant theories of IAP education. This needs to take into account the specific purpose and the effect of the assessment. The construction of the assessment index system of IAP education in IHL should reflect the ultimate goal of IAP education in IHL under the guidance of Marx's theory of all-round development of human beings. The design of assessment indicators of IAP education in IHL should fully follow this general direction and the principle of "people-oriented" and promote its all-round development on the premise of adapting to social needs. Only when the effective factors, effective process and effective results of IAP education are fully considered, can the assessment work be guaranteed to achieve actual results. The purpose of IAP education in IHL is a reflection of the fundamental requirements of the country and should be the main basis for the formulation of assessment indicators and indicator standards.

(3) Correlation analysis of assessment index system

The correlation of the assessment index system is shown in Figure 3.

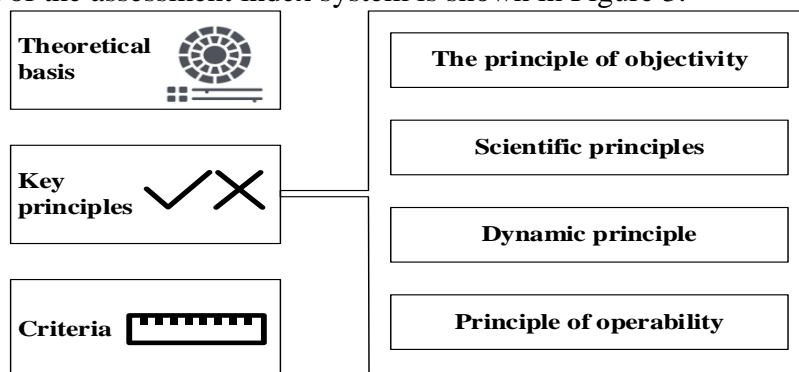


Figure 3: Assessment indicator system structure

1) Theoretical basis of assessment index

The theory of students' moral structure and development provides a direct theoretical basis for the construction of the assessment index system of IAP theory teaching in IHL. The ideological and moral structure is the way of interaction and connection between the various factors that constitute people's IAP morality. The ideological and moral structure of college students is composed of

cognition, emotion, will, faith, belief and behavior. In the course of IAP theory in IHL, every factor and link would have a direct impact on the ideological and moral structure of college students. Therefore, the teaching assessment of the IAP theory course in IHL is not only to measure the students' mastery of the basic theoretical knowledge of Marxism, but also to measure the students' level of applying Marxist theory to life practice to solve practical problems. It is necessary to measure whether the students are firm in their ideals and beliefs and their moral behavior on the socialist system and the path of socialism with Chinese characteristics.

2) Main principles of assessment indicators

Goal principle: First of all, it requires that the assessment should adhere to the correct political direction, and the education goals directly provide the basis for education assessment. To take the socialist road in education and teaching, education and teaching must be reviewed. The assessment index system must be based on the national education standards, laws, regulations and task objectives, and it would continue to promote the comprehensive and unrestricted growth of college students as the fundamental starting point and foothold of teaching assessment.

Scientific principle: To construct the assessment index system of IAP theory courses in IHL, it must conform to the nature, process, characteristics and laws of IAP theory courses in IHL, and correctly reflect the basic contradictions in the teaching activities of IAP theory courses-internalization and externalization.

Dynamic principle: The improvement of the assessment index system is a dynamic process. On the one hand, it is because the research on the assessment index system of IAP theory teaching is still in the exploratory stage. Whether in theory or in practice, they are constantly developing and changing. The background and social reality of building the assessment index system of IAP theory courses in IHL are changing. Therefore, the construction of the assessment index system of IAP theory teaching in IHL must keep pace with the times, control in real time, keep time and update the content in time to adapt to the development of the situation. On the other hand, in order to establish a scientific, comprehensive and operable teaching assessment index system, it is necessary to break the original thinking pattern of "evaluating teaching by teaching" and run through the development thought. Teachers should be guided to design their own teaching according to the assessment indicators, re-examine teaching, attach importance to self-assessment in teaching and weaken the role of assessment indicators in selection, reward and punishment. The concept of "based on the development of students, and learning on teaching" should be established to fundamentally achieve the purpose of teachers "teaching" to serve students "learning", so as to improve the quality and level of IAP theory teaching.

Principle of operability: It is separated from the actual situation of the IAP theory course in IHL, and lacks operability. No matter how complete the assessment index system is, it cannot play its due role. Therefore, this should ensure that the assessment index system of IAP theory courses in IHL is complete and at the same time achieve the operability of the assessment index and assessment elements. This requires that the assessment criteria set should be moderate and the assessment criteria should be on the high side, which cannot distinguish the differences of teaching effects and cannot play an incentive role; the assessment index is too high, which is easy to attack the enthusiasm of teachers and students. When determining the specific indicators, it should be based on the current basic situation of IAP theory teaching and should not exceed the limits of the actual conditions too much, otherwise it would not achieve the purpose of assessment, and may even mislead. At the same time, when measuring the assessment indicators, it should adopt a combination of qualitative and quantitative methods to make the teaching assessment results more comprehensive, objective and accurate.

3) Criteria for assessment indicators

The teaching index of the IAP theory course in IHL is an objective measure to measure whether

the course teaching can achieve the goal and the expected effect. Standardization standard of teaching elements and processes: The teaching situation of IAP theory courses in IHL needs to be evaluated. It is required to evaluate the completeness of teaching elements and teaching process, that is, it needs to allocate teaching elements and implement teaching links according to the specific current and objective requirements of the teaching scheme. This standard is mainly reflected in the basic terms and standard requirements on teaching elements and teaching process in the teaching plan of IAP theory courses in IHL. The discussion and mastery of this standard is a comprehensive and accurate assessment of the teaching of IAP theory courses in IHL, which is an inevitable requirement for promoting the standardization and scientific development of IAP theory courses in IHL. The specific teaching elements of IAP theory course in IHL include teachers, students, teaching objectives, textbooks and teaching conditions. Whether these teaching elements are complete or not, there are clear provisions and requirements for both the education authorities and universities, which is also an important standard for evaluating whether the teaching elements of IAP theory courses in universities are standardized or not. It should be noted that the standard of teaching elements is not only the integrity of teaching elements, but also the quality of teaching elements.

Normative standard of teaching process: In the teaching of IAP theory courses in IHL, each teaching stage and teaching link has specific provisions and requirements, which is the objective standard to evaluate whether the IAP theory courses in IHL are standardized. The criteria and yardstick for investigating students' mastery of knowledge in IAP theory courses in IHL can be divided into examination criteria, assessment criteria and comprehensive investigation criteria, which have their own advantages and characteristics. The examination standard, as the specific criterion and yardstick of the teaching assessment of the IAP theory course in IHL, has its rationality. As far as the assessment of IAP theory teaching in IHL is concerned, the assessment criteria mainly refer to the assessment of students' learning and mastering of the content. The following aspects should be paid attention to in the assessment process: The assessment criteria should be specific and not vague; the standards should be moderate, dynamic, and conform to the curriculum objectives. As an important standard to measure the optimization of students' knowledge structure, the comprehensive examination standard is the product of the combination of examination and assessment standards.

Quality standards such as ideological and moral quality assessment as the main, comprehensive quality assessment index system as the auxiliary: The IAP theory courses in IHL should not only enable students to obtain basic theoretical knowledge, but also encourage students to internalize knowledge into quality and constantly improve ideological and moral quality and comprehensive quality. The quality standard is a standard to measure the development of a person's ideological and moral quality and the overall development of a person's quality. In the course of IAP theory in IHL, it is necessary to consider whether the knowledge taught can be internalized into the quality of students, and whether the quality of college students can be developed comprehensively, harmoniously and qualified. According to the different types of quality, quality standards can also be divided into ideological and moral quality assessment standards and comprehensive quality assessment index system. In order to check whether the IAP theory course in IHL is well developed, it is also necessary to take the ideological and moral quality as the standard of assessment.

Practice standard: The so-called practice standard is to inspect and assess the IAP quality and comprehensive qualities of college students based on practice, and then inspect and assess the teaching of IAP theory in IHL. The reason why the practice standard has become the ultimate standard of assessment is that the ideological and moral quality and comprehensive quality of people cultivated by the teaching of IAP theory courses in IHL must pass the test of practice. Social practice is not only the basic standard to investigate the ideological and moral quality and

comprehensive quality of talents, but also the IAP theory course in IHL to assess the ideological and moral quality and comprehensive quality of talents.

4. Data Mining Education Index Assessment Innovation

(1) Construction of judgment matrix

After the recursive level is established, the importance of projects at the same level relative to the standards at the previous level is evaluated in pairs. The root based method is used to approximate the maximum eigenvalue in the judgment matrix. The calculation steps are as follows:

Each element in each row of the matrix is multiplied to the nth power, as shown in Formula (1):

$$\varpi_i = \left(\prod_{j=1}^n a_{ij} \right)^{1/n} \quad i = 1, 2, \dots, n \quad (1)$$

The approximate eigenvector is normalized, as shown in Formula (2):

$$\omega_j = \frac{\varpi_j}{\sum_{i=1}^n \varpi_i} \quad j = 1, 2, \dots, n \quad (2)$$

The approximate value of the maximum characteristic root is calculated, as shown in Formula (3):

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^n \frac{(A\omega)_i}{\omega_i} \quad (3)$$

Among them, $(A\omega)_i$ represents the ith element of vector $(A\omega)$.

(2) Hierarchical single sorting and consistency test

When the consistency index of the matrix is 0, the judgment matrix has complete consistency; the larger the consistency index numerator, the worse the consistency of the judgment matrix. In order to test whether the judgment matrix has satisfactory consistency, it is necessary to compare the consistency index with the average randomness index. The consistency test is shown in Formula (4):

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (4)$$

It is substituted into model A, as shown in Formula (5):

$$CR(A) = \frac{CI}{RI} \quad (5)$$

5. Investigation on Satisfaction of Assessment Index System of IAP Education in IHL

The opinions of 200 college IAP teachers are selected as samples, and 200 questionnaires are distributed. 200 questionnaires are collected and 200 valid ones are collected. The recovery rate is 100%, and the effective rate is 100%. The questionnaire takes the satisfaction degree of data mining teaching assessment of college IAP teachers as the research object, and conducts the survey from multiple levels and angles. Variables focus on various forms of data mining teaching assessment methods used in the IAP classroom, which involves the whole process of classroom teaching. The scoring range is 1-5 points. The questionnaire indicators are shown in Table 1.

Table 1: Questionnaire indicators

Type	Score
Assessment Process	1-5
Assessment Effect	1-5
Evaluating human-computer interactivity	1-5

(1) Process satisfaction

The use of the new model can develop from explicit and overall assessment to process assessment. The content of IAP teaching assessment would also change from a single assessment focusing on students' ability and performance to a comprehensive assessment, thus forming a dynamic and comprehensive assessment mechanism. The comparison of average scores of 200 college IAP teachers' satisfaction with the assessment process is shown in Figure 4.

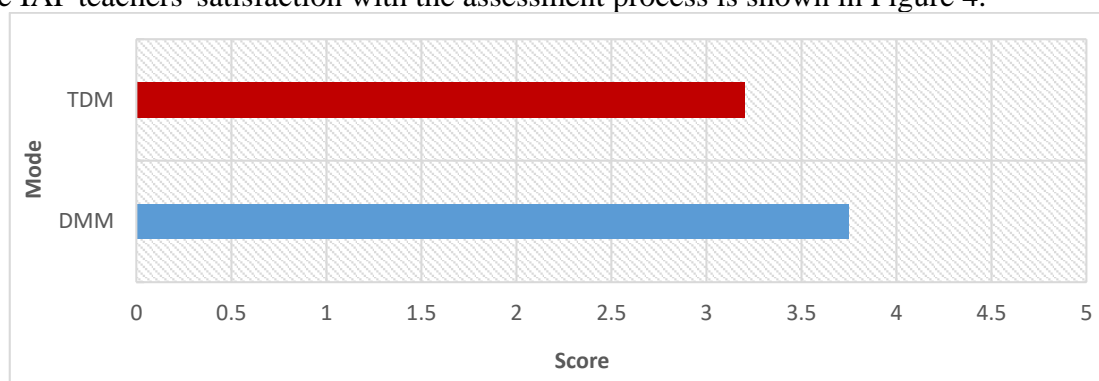


Figure 4: Comparison of average scores of satisfaction with the assessment process

Figure 4 shows the average score of the satisfaction of the IAP teachers in the sample with the teaching assessment process of the two models. The average score of satisfaction with the teaching assessment process of the college IAP teaching index assessment system based on data mining algorithm is 3.75, and the average score of satisfaction with the teaching assessment process of the traditional college IAP teaching index assessment system is 3.2. The assessment system of college IAP education indicators based on data mining algorithm is slightly better.

(2) Effect satisfaction

The comparison of average scores of satisfaction with assessment results of 200 IAP teachers in IHL is shown in Figure 5.

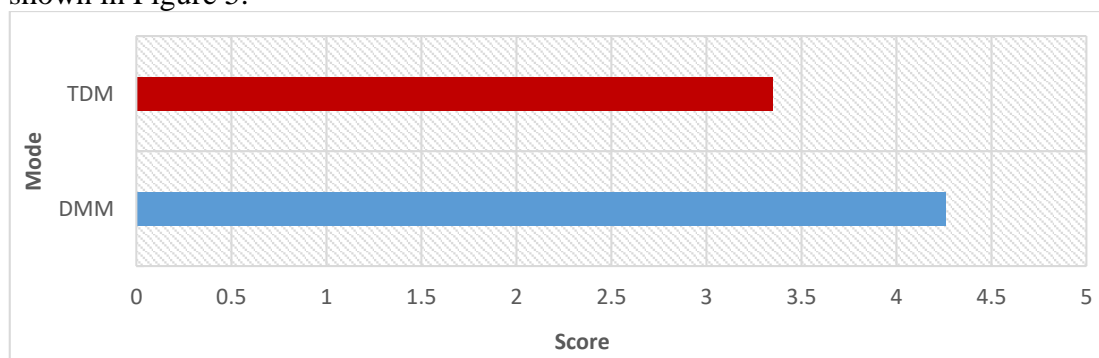


Figure 5: Comparison of average assessment effect satisfaction scores

Figure 5 shows the average score of the satisfaction of the IAP teachers in the sample with the teaching assessment results of the two models. Among them, the average score of the sample for the teaching assessment effect satisfaction of the college IAP teaching index assessment system based on data mining algorithm reaches 4.26, and the average score for the teaching assessment effect

satisfaction of the traditional college IAP teaching index assessment system is 3.35.

(3) Satisfaction with human-computer interaction

The average score comparison of human-computer interaction satisfaction is shown in Figure 6.

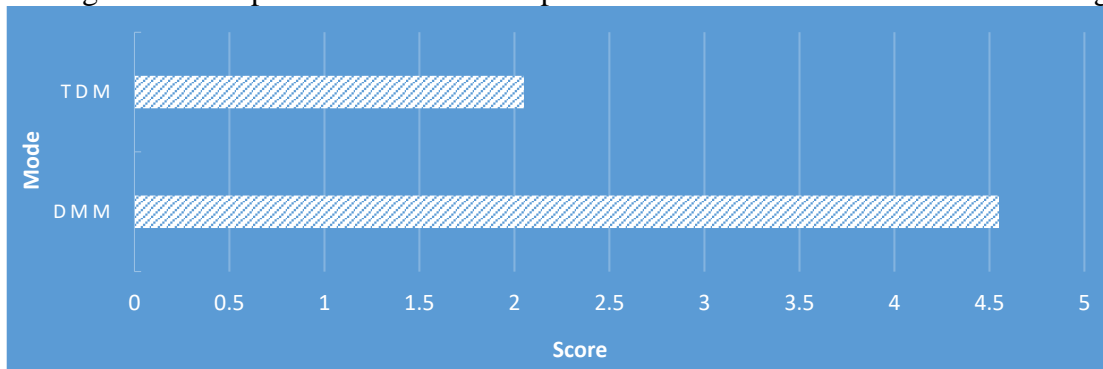


Figure 6: Mean score of satisfaction with human-computer interactivity

Figure 6 shows the average score of the satisfaction of the IAP teachers in the sample with the human-computer interaction of the two modes of teaching. Among them, the average score of the sample for the human-computer interaction satisfaction of the college IAP education index assessment system based on data mining algorithm reaches 4.55, and the average score for the human-computer interaction satisfaction of the traditional college IAP education index assessment system is 2.05. It can be seen that the traditional mode has almost no human-computer interaction.

(4) Evaluate comprehensive satisfaction

The average scores of the above sample teachers are calculated to get the comprehensive satisfaction score comparison, as shown in Figure 7.

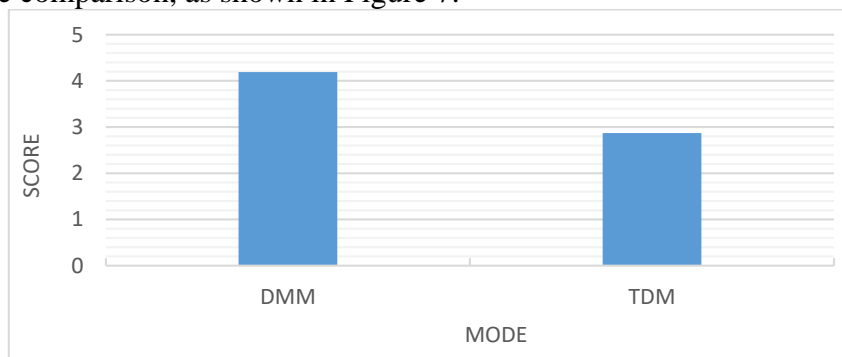


Figure 7: Overall satisfaction rating comparison

Figure 7 reflects the comparison of comprehensive satisfaction scores. Among them, the comprehensive satisfaction score of the sample for the college IAP teaching index assessment system based on data mining algorithm is about 4.19, and the comprehensive satisfaction score for the traditional college IAP teaching index assessment system is about 2.87. The college IAP education index assessment system based on data mining algorithm is superior to the traditional college IAP education index assessment system.

6. Conclusions

The construction of the assessment index system of IAP education in IHL is a systematic project that needs to be studied theoretically and discussed in practice. Based on the multi-modal learning type data mining algorithm, this paper designed the assessment system of IAP education in IHL, and took the theoretical basis of the construction of the assessment index system of IAP education

in IHL as the logical starting point. The effectiveness of IAP education was taken as the basis for the construction of the assessment index system. The goal of IAP education in IHL was used as the assessment standard to establish the foundation, which laid a theoretical foundation for solving problems. The results of process satisfaction, effect satisfaction, human-computer interaction satisfaction and comprehensive assessment satisfaction were obtained. Among them, the human-computer interaction of the system was outstanding. On the premise of scientific understanding of the assessment connotation of IAP education activities in IHL, this paper broke the dilemma of defining the scope of IAP education in IHL and improved the assessment level of IAP education indicators in IHL.

References

- [1] Gunn Andrew. "Metrics and methodologies for measuring teaching quality in higher education: developing the Teaching Excellence Framework (TEF)." *Educational Review* 70.2 (2018): 129-148.
- [2] Cadez Simon, Vlado Dimovski, and Maja Zaman Groff. "Research, teaching and performance evaluation in academia: the salience of quality." *Studies in Higher Education* 42.8 (2017): 1455-1473.
- [3] Grissom Jason A, and Brendan Bartanen. "Strategic retention: Principal effectiveness and teacher turnover in multiple-measure teacher evaluation systems." *American Educational Research Journal* 56.2 (2019): 514-555.
- [4] Liu Guangxin. "The ways and methods of ideological and political education for postgraduates." *Advances in Educational Technology and Psychology* 5.3 (2021): 80-87.
- [5] Xiao Shungen. "Teaching reform of CNC technology course under the ideological and political education." *International Journal of Social Science and Education Research* 2.10 (2019): 36-41.
- [6] Khan Anupam, and Soumya K Ghosh. "Data mining based analysis to explore the effect of teaching on student performance." *Education and Information Technologies* 23.4 (2018): 1677-1697.
- [7] Sorour Shaymaa E, Kazumasa Goda, and Tsunenori Mine. "Comment data mining to estimate student performance considering consecutive lessons." *Journal of Educational Technology & Society* 20.1 (2017): 73-86.
- [8] Francis Bindhia K, and Suvanam Sasidhar Babu. "Predicting academic performance of students using a hybrid data mining approach." *Journal of medical systems* 43.6 (2019): 1-15.
- [9] Adekitan Aderibigbe Israel, and Etinosa Noma-Osaghae. "Data mining approach to predicting the performance of first year student in a university using the admission requirements." *Education and Information Technologies* 24.2 (2019): 1527-1543.
- [10] Bharara Sanyam, Sai Sabitha, and Abhay Bansal. "Application of learning analytics using clustering data Mining for Students' disposition analysis." *Education and Information Technologies* 23.2 (2018): 957-984.
- [11] Parker Walter C., Sheila W. Valencia, and Jane C. Lo. "Teaching for deeper political learning: a design experiment." *Journal of Curriculum Studies* 50.2 (2018): 252-277.
- [12] Wang Yuxia. "Ideological and political teaching model using fuzzy analytic hierarchy process based on machine learning and artificial intelligence." *Journal of Intelligent & Fuzzy Systems* 40.2 (2021): 3571-3583.
- [13] Ramachandram Dhanesh, and Graham W. Taylor. "Deep multimodal learning: A survey on recent advances and trends." *IEEE signal processing magazine* 34.6 (2017): 96-108.
- [14] Di Mitri Daniele. "From signals to knowledge: A conceptual model for multimodal learning analytics." *Journal of Computer Assisted Learning* 34.4 (2018): 338-349.
- [15] Hibbeln Martin Thomas. "How is your user feeling? Inferring emotion through human-computer interaction devices." *Mis Quarterly* 41.1 (2017): 1-21.