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Article

English Teaching Project Quality Evaluation Based on Deep Decision-Making and Rule Association Analysis

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Abstract: A large amount of course data has been accumulated in the long-term teaching activities of universities. It is of great research value to use the data resources to analyze the course teaching status and provide decision support for improving the course teaching quality. In this paper, we design and implement a course evaluation system based on association rules and cluster analysis, analyze the functional requirements of the course evaluation system, and pre-process the course evaluation data. Students' performance data are analyzed by FP-growth association rules, and then clustered by K-means, which can improve the accuracy of data evaluation.The evaluation index system of university English teaching quality under the concept of "Thinking and Government" is established. With the results of the sample survey, the main problems of the evaluation method are summarized and analyzed, and corresponding suggestions are put forward, which provide an important reference for promoting the reform of college English course.

Keywords: Course Evaluation, Association Rules, Cluster Analysis, Decision Support, Teaching Quality

1. Introduction

The university English course is both instrumental and humanistic, which puts forward higher requirements for the effective, targeted and affinity strengthening of ideological and political education in the professional courses' Civics elements, curriculum and teaching methods, etc [1]. The research of the university English course needs to be strengthened in continuous improvement in order to meet the needs of students' growth and development. How to plant this responsible field of college English course is especially important for the smooth implementation of curriculum thinking and politics [2]. The key evaluation link to test the harvest of this field is the evaluation link. The construction of a scientific and standardized, practical evaluation system will meet the requirements of the university English course, the development of students and the development of teachers, so that it will have a positive impact on the evaluation of the teaching of the university English course. The evaluation system will eventually play a service role in the subsequent decision making and promote the realization of the fundamental goal of "establishing moral education for people" [3].

At present, the research results on the establishment of the quality evaluation system of college English teaching under the study are relatively few, and the related evaluation methods vary widely and have mixed reviews in various universities, most of the studies point to the macro path or teaching pedagogy, and many scholars also mention the assessment methods and evaluation modes in their

studies, but only briefly summarize them [4]. Drawing on the theory of result-oriented education for engineering certification, the evaluation system of college English cultivation goal achievement proposes improvement measures in three latitudes: knowledge transfer, ability cultivation and value shaping, and traces each link in the process of education and teaching [5]. The scientific and reasonable articulation of professional knowledge points with the knowledge points of Civic Education and the effective evaluation of the curriculum can promote the development of teaching reform, achieve good practical effects, and ensure the simultaneous improvement of the quality of college English teaching and the quality of Civic Education of the curriculum. How to improve the evaluation body of teaching quality under the course Civic Education from the level of process and result, all-round and multi-level, static and dynamic that needs to be solved [6].

The fundamental purpose of teaching quality management is to form a continuous improvement mechanism of teaching quality and to ensure teaching quality improvement [7]. Curriculum quality is the primary factor affecting teaching quality improvement in higher education, and all higher education reform concepts and ideas are ultimately implemented into and through the implementation of the curriculum [8, 9].

Established experience shows that external factors such as investment in educational resources, external accountability and evaluation do not necessarily improve the quality of education, and promoting the quality of teaching and learning within higher education is the fundamental way to solve the problem. Therefore, by collecting, analyzing and evaluating information on the operation status of undergraduate courses, teachers, students, experiments and videos, establishing an undergraduate course evaluation system and its supporting system and using it in undergraduate teaching management services will enhance the core competitiveness of education reform [10]. How to use these teaching information rationally in order to obtain potential knowledge useful for teaching and make forward-looking decisions has become an urgent problem for universities to solve.

We design and implement a course evaluation system based on association rules and clustering analysis for course evaluation technology with the goal of improving teaching quality and providing data analysis and decision support functions. The system addresses the problem that the traditional course evaluation system singularly takes grades as the only criterion, uses a more objective combination of quantitative and qualitative course evaluation principles, breaks the geographical and time constraints, saves a lot of labor and time costs, and automates the collection of course evaluation data and course evaluation processing. At the same time, systematic analysis of course data has yielded a decision support basis that helps improve teaching quality and provides teachers and professors with professional responsibility on a reference basis for continuous improvement.

2. Construction of Evaluation Index System

According to the competency theory proposed by [11], as a teacher of English at the university level cultivates high-quality language skills, professional skills such as teaching experience and teaching ability are the main manifestations of teachers' competencies; subjective "professional attitudes or values" and objective "professional knowledge and skills" are the main manifestations of teachers' competencies [12]. Subjective evaluation is quantifiable, observable, perceptible and imitable; objective evaluation is measurable and descriptive, and teachers' excellent behavioral performance can be demonstrated in concrete form or measured by a specific quantity or index.

2.1. Principles of Constructing Evaluation Index System

According to the actual need of teaching quality evaluation, the setting of the index system adheres to the following principles,the specific content is shown in Table 1.

1. The design of evaluation indexes should be truly and objectively reflect the inner laws of teaching, the current situation, the existing problems and the development potential, and conform to

Index	concrete content
plan	Formulate a comprehensive curriculum ideological and political teaching plan
	Timely adjust the teaching plan
devices	The teaching informative
	The teaching can reflect frontier
	Organizing diversified ideological and political teaching
	Open or elective courses
	Participate construction online teaching
	Undertake teaching reform
process	conforms to the syllabus, reasonable and rich
	pronunciation standard, fluent; Explain clearly and methodically
	Care for students, teach and educate people
	The class energetic and infectious
attitude	manage classroom discipline
	Be kind and generous
	Answer questions carefully
	Pay attention to the feedback of homework information
	The class time arranged reasonably
effectiveness	The students can solve problems, learn and innovate
	The school curriculum Ideological and political participation
	Students listen carefully

Table 1. Teaching Quality Evaluation

the basic principles of pedagogy and psychology [13].

2. The designed evaluation index system and its evaluation results are easy to be compared between schools and can be generalized in different schools and different majors.
3. Not only should the complex factors of interdependence and mutual constraints be considered as a whole and the system concept be adhered to, but also the system should be clearly organized and hierarchically structured to avoid the index system being too cumbersome and complicated, so as to be operable for later evaluation and data collection.

2.2. Quality Evaluation Index System

Based on the above principles, 6 first-level indicators and 19 second-level evaluation indicators are set in consideration of the teaching plan, teaching methods, teaching process, teaching attitude and teaching effective. As shown in Table 2 that teachers organize and record evaluation activities, guide and help students, and students act as the center of the evaluation system to achieve three-dimensionality, diversity, pluralism and flexibility in evaluation contents, evaluation subjects, evaluation standards and evaluation methods [14, 15]. Avoiding summative evaluation and overcoming a series of problems such as simplistic evaluation methods, single subject, and lack of comprehensiveness and accuracy.

3. Satisfaction Questionnaire Design

The satisfaction survey is different from the assessment of teaching work level and professional assessment [16]. A sample questionnaire is designed and a scoring method is used to understand the degree of influence of each index on teaching quality in people's mind. Through the questionnaire survey, optimize the index system, eliminate unreasonable items and add new indicators appropriately. The questionnaire was divided into two parts, the first part was a scoring scale, and the second part

Secondary index
Formulate a comprehensive curriculum ideological and political
Timely adjust the teaching plan
content rich and informative
The teaching content can reflect frontier
The teaching Ideological and political
Open or elective courses
online teaching resources
publish teaching related papers and monographs
lecture information is reasonable and rich

Table 2. Teaching Quality Evaluation Index

Satisfaction	Score range	Satisfied	Dissatisfied	Very dissatisfied
Score range	64-80	48-64	32-48	0-32

Table 3. Respondents' Overall Satisfaction Scale

was a supplementary question asking the respondents to propose new indicators [17].

Satisfaction of each respondent with the scale according to Table 3, which is a scale of the overall satisfaction of the respondents. The second is the satisfaction of all respondents with each individual indicator, the sum of individual indicator scores, which are used to guide the optimization of individual indicators, Table 4 is the individual indicator satisfaction score scale [18, 19].

4. Course Evaluation Based on Association Rules and Cluster Analysis

4.1. Analysis of Association Rules

The traditional Apriori algorithm generates a large number of candidate item sets and requires repeated scanning of the entire database in order to complete pattern matching, which is particularly expensive. Frequent pattern growth (FP-growth) algorithm can mine the entire set of frequent items without generating a costly set of candidates [20].

Based on the pre-processing of the data, association rules are mined from the examination results data to discover the interplay between different courses, to help the professor responsible for the profession to reasonably formulate the professional training plan, to cultivate more comprehensive professional talents, and to further improve the quality of teaching.

On the basis of not ignoring important rules and not generating a large number of useless rules, the minimum support count was finally set to 50 and the minimum confidence level was set to 0.85 after several experiments. Some of the association rules of course mined using the FP-growth algorithm on course grade data are shown in Table 5.

4.2. Course Grade Data type Dissimilarity Metric

The traditional K-means algorithm selects k samples randomly from the dataset as clustering centers when choosing the initial clustering centers, and the different initial clustering centers easily lead to completely dissimilar clustering results. In the face of different data types, data mining techniques often require the use of different dissimilarity measures. In this paper, student achievement data are

Satisfaction	Score range	Satisfied	Dissatisfied	Very dissatisfied
Score range	208-260	156-208	104-156	0-104

Table 4. Scale of Satisfaction with Individual Indicators

Antecedent	Consequent	Confidence level/%
Linear algebra Theory of probability Digital logic	Discrete mathematics	90.00
Assembly language Micro computer principles	Operating system	96.29
College English Introduction to computer	Computer professional English	88.76
Assembly language Composition principle Computer architecture	Microcomputer principles	97.23

Table 5. Course Association Rules

generally numerical type data, which are transformed into binary type data after discretization preprocessing, and their phase dissimilarity measures are introduced here.

Student achievement data are expressed as integer or real values. Different units of measurement affect the clustering results, so the data should be normalized before calculating the distance to minimize the influence of the units of measurement on the clustering results. Let student achievement data $i = \left(x_{i1}, x_{i2}, \cdots, x_{ip}\right)$ and $j = \left(x_{j1}, x_{j2}, \cdots, x_{jp}\right)$ contain p numerical attributes, i and j represent student achievement vectors, and the common distance measures are as follows:

1. Euclidean distance

$$d(i, j) = \sqrt{\sum_{k=1}^{n} \left(\mathrm{x}_{ik} - \mathrm{x}_{jk}\right)^2}. \tag{1}$$

2. Manhattan distance

$$d(i, j) = \sum_{k=1}^{n} \left|\left(x_{ik} - x_{jk}\right)\right|. \tag{2}$$

1. Minkowski distance

$$d(i, j) = \left(\sum_{k=1}^{n} \left|x_{ik} - x_{jk}\right|^p\right)^{1/p}. \tag{3}$$

Discrete test score data have only two states, 0 or 1, where 0 means that the student test score is less than or equal to the average score and 1 means that the student test score is greater than the average score. The binary symmetric phase anisotropy is calculated as follows:

$$d(i, j) = \frac{b + c}{a + b + c + d}. \tag{4}$$

4.3. Course Evaluation Results

The data set shown in Figure 1 is selected. The data set contains 8 grade data samples, and the horizontal coordinates of the graph represent the usual grades and the vertical coordinates represent the exam grades. To simplify the calculation, the serial numbers of the samples in the dataset (usual grades, exam grades) are No. 1 (3,4), No. 2 (4,4), No. 3 (3,3), No. 4 (4,3), No. 5 (0,2), No. 6 (1,2), No. 7 (0,1), No. 8 (1,1).

Assuming that the algorithm randomly selects number 6 as the initial cluster center, the distance D(x) from each sample in the dataset to the initial cluster center and the probability P(x) of being selected as the next cluster center. In this example, the interval is divided into [0,0.2), [0.2,0.525),..., [0.975,1], and if the generated random number is 0.3, then the random number falls into the interval [0.2,0.525), according to which number 2 is selected as the next cluster center. According to the value

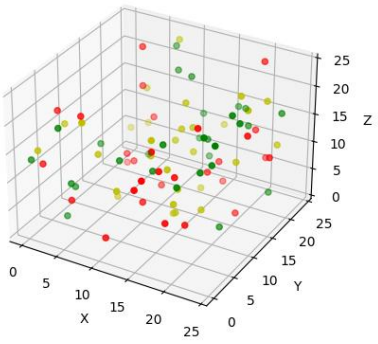

Figure 1. Example of K-means++ Algorithm

Type	Standardized test scores	Stan dardized regular scores
First	0.9862	0.8824
Second	0.9598	0.7149
Third	0.9422	0.4379
Fourth	0.6000	0.5975

Table 6. Final Clustering Centers for Discrete Mathematics Courses

of S, the probability that the second initial cluster center is one of No. 1, No. 2, No. 3, and No. 4 is 0.9, and the four points are exactly the points farther away from the first initial cluster center, which also verifies the idea of K-means++ algorithm that the points farther away from the existing cluster center. Repeat the above steps using the roulette wheel method to generate all the required k initial clustering centers.

The K-means++ algorithm solves this problem by mixing different types of students from the test data, even if there is some variation in test difficulty. K-means++ algorithm clusters discrete mathematics courses, and the final clustering center results obtained are shown in Table 6.

As can be seen from Table 6, Category 1 students performed well on both their exams and their regular grades; Category 2 students performed well on their exams but their regular performance was more average; Category 3 students performed well on their exams but their regular performance was particularly bad; and Category 4 students hovered around the passing line on their exams and regular grades and performed poorly.

Analyzing the above clustering results, the learning characteristics of various types of students in this course can be found, which leads to the following conclusions that help teachers improve the quality of teaching.

1. Category 1 student mastered the course proficiently, performed well in general, and eventually achieved very good grades.
2. Students in category 2 have little difference in their mastery of the course compared with students in category 1, but their usual performance is average, probably due to a certain degree of absence, failure to submit assignments or poor completion of experiments, etc. These students need to strengthen their self-discipline and improve the requirements for themselves in their usual course study.
3. Students in category 3 perform well on exams but have very poor grades in regular classes. The reason for this may be that they have achieved good grades because of intense revision before exams, but they may have more serious absenteeism, failure to turn in assignments, and failure to complete labs in regular classes, causing their overall grades to be much lower than their exam grades [9].

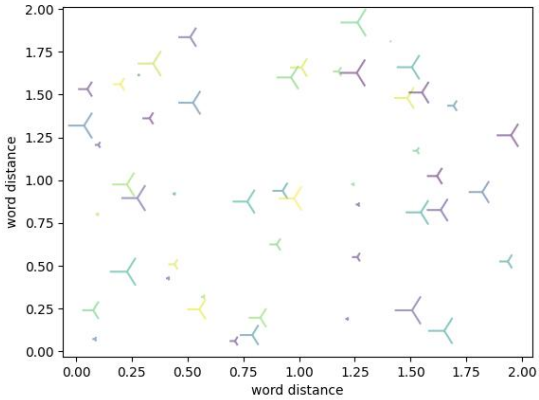

Figure 2. Word Scatter Diagram

4. Category 4 students have poor performance in both exam and regular grades, and have low mastery of course knowledge, which may be due to not studying the course content seriously or poor learning ability of students [12].

In summary, teachers need to focus on the usual performance of students in categories 3 and 4 when teaching the course, who tend to have a poor learning attitude. There may be some students in category 4 who have poor learning ability. This part of students need to be encouraged to ask more questions to teachers and classmates in the usual course in order to understand the knowledge points they do not understand as soon as possible, and at the same time, diligence can make up for poor performance.

In addition, by analyzing the above association rules. Further conclusions that can help managers' decisions can be summarized, as shown in Figure 2.

As seen from Figure 2 that it is more reasonable to arrange University English, assembly language, linear algebra, probability theory and digital logic in the training course for freshmen and sophomores, which can help students to build a solid foundation for their expertise in subsequent courses.

Since the course of Microcomputer Principles, Computer English and Computer Operating Systems are relatively comprehensive, they are difficult for some students with poor learning ability. Therefore, these courses are more suitable for junior students.

5. Conclusions

The improvement of the evaluation index system of the quality of college English teaching is in line with the torrent of the time of the research on curriculum thinking and politics. The optimized index system can reflect the specific status of college English teaching more comprehensively, and is also a powerful motivation to promote the realization of the reform goal of curriculum thinking and politics, which is of great significance to the investment practice and theoretical system improvement in terms of the effectiveness of human education. In this paper, we use FP-growth algorithm for correlation rule analysis and K-means++ algorithm for clustering analysis on course achievement data to get a decision support basis that can help improve teaching quality, provide teachers and professors with professional responsibility with a reference basis for continuous improvement, provide students with more refined and personalized services, and effectively improve student achievement.

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Conflict of interest

The author declares no conflict of interests.

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