Research Inventy: International Journal of Engineering And Science
Vol.14, Issue 9 (September 2024), PP 17-20
Issn (e): 2278-4721, Issn (p):2319-6483, www.researchinventy.com

Class Clustering Model and Evaluation of Practical Courses based on Interest Mining

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Abstract: *This paper analyzes the importance of practical teaching in higher vocational education, and based on this research background, it constructs a student interest mining method based on clustering model for class interest grouping in practical courses. By constructing the student interest vectors and calculating the closeness between the vectors, a clustering objective function based on the norm model is established to achieve the class student interest clustering and construct the class grouping. This paper studies the application of subjective evaluation method, objective evaluation method, grouping evaluation method and other methods in the process of class grouping and practical teaching. The method constructed in this paper is a highly feasible model for vocational education teaching, which can provide reference and inspiration for guiding vocational education in teaching practice.*

Keywords: *Interest mining, Practical courses, Class grouping, Teaching evaluation*

Date of Submission: 28-08-2024 Date of acceptance: 08-09-2024

I. INTRODUCTION

Practical course is a very important part of higher vocational education, occupying almost half of the course teaching time. The purpose is to enhance students' hands-on practical abilities and comprehensive qualities, ensuring that they can seamlessly integrate with practical work upon graduation. Therefore, in higher vocational education, a course usually consists of two components. One is a theoretical course, which explains basic knowledge and concepts to students through theoretical lectures, allowing them to master the basic laws and content of the subject. The other is a practical course, which transforms the theoretical knowledge learned in the classroom into practical skills that can be applied to work through skill training, skill operation and skill display, in order to cultivate students' specific work abilities. At present, intelligent teaching is a research field that deeply integrates artificial intelligence technology, data mining technology, and teaching methods. Its main research method is to transform traditional teaching methods into intelligent ones by analyzing specific methods in the teaching process, in order to enhance the informatization and intelligence level of teaching methods, effectively improve the efficiency and quality of the teaching process, make the teaching process more convenient for teachers, and increase student satisfaction in class. Therefore, researching information-based teaching methods and achieving intelligent teaching is the inevitable path for the future development of higher vocational education.

The use of group discussions in practical courses is highly effective for teaching process for cultivating divergent thinking, discussing solutions, and expressing team perspectives. Therefore, the criteria for grouping has always been the key to the educational research, that is, how to effectively group students in a class, so that each group of students has common aspirations, interests, or viewpoints, and can generate correct and distinctive conclusions from other groups. This is the main teaching method of practical courses that use discussion as the main teaching method. Before preparing for a practical class, teachers need to determine the practical discussion topic based on the teaching plan, and then determine the direction of group discussion based on the discussion topic. After determining these topics, interest mining algorithms are used to achieve student clustering, obtain class groups, and then conduct discussions based on the grouping situation. Each group evaluates each other and obtains their own opinions.

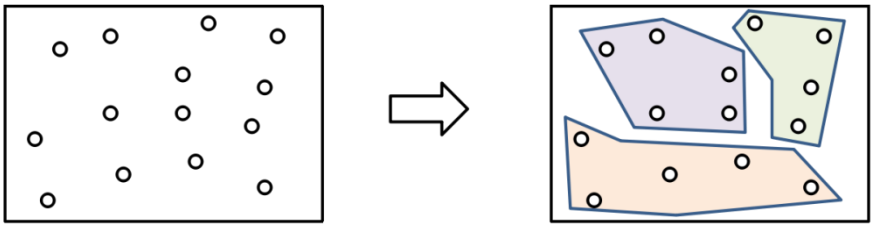
Through the analysis of the organizational ideas of practical courses, it can be concluded that determining the discussion topics, implementing class grouping, and evaluating teaching discussions are the three most important aspects of practical courses. In this study, we develop a method of using clustering models to achieve class grouping, grouping students with different interests and hobbies, so that students within the same cluster have similar interests, while students in different clusters have different interests. Through this

method, effective grouping of class students is achieved, which facilitates the organization, implementation, and evaluation of practical courses.

II. CLASS STUDENT INTEREST GROUPING BASED ON CLUSTERING MODEL

The process of constructing a clustering model to achieve class grouping conforms to the clustering rules. Students in a class can be viewed as points with discrete distributions in space, and each point has interest and hobby features that can be quantified in the form of vectors. The similarity between a vector with multiple eigenvalues and another vector is determined by the spatial distance between the two vectors. The closer the spatial distance, the closer the vectors are; The farther the spatial distance, the more distant the vectors are. The closer the interest features are, the more likely they are to cluster together within the same cluster. Figure 1 shows an example of clusters obtained by clustering discrete points in space by using interest vectors.

Figure 1. Example of clusters obtained by clustering discrete points in space by using interest vectors



To achieve interest clustering among students in a class, it is necessary to firstly collect and quantify the characteristics of students' interests and hobbies. We take rural tourism in the course of New Tourism Industry as an example to establish a data collection method. Based on the collected data, we construct interest feature vectors for students, and then use quantitative vectors to establish clustering objective functions to achieve class student clustering. After clustering and grouping, teachers organize practical teaching, and students in each group discuss and evaluate the clustering and grouping process as well as the teaching implementation process.

When discussing rural tourism as the main topic, it can be divided into many hot topics, such as rural culture, rural cuisine, rural customs, rural farming, rural regimen, etc. Determine interest tags for each classification topic, as shown in Table 1. In Table 1, each topic contains 6 tags, each corresponding to a score range of 1.0-10.0, used for students to score and determine their interests and hobbies. The higher the score, the higher the student's interest in the label.

Table 1. Classification of Topics (Interests) for Discussion on New Forms of Rural Tourism

Type	**Interest tag**					
score	1.0-10.0	1.0-10.0	1.0-10.0	1.0-10.0	1.0-10.0	1.0-10.0
rural culture	Art activities	cultural activities	farming system	agricultural ideology	agricultural technology	traditional crafts
rural cuisine	Food making	food tasting	food knowledge	food exhibitions	food festivals	Food regimen
rural customs	Wedding customs	birthday customs	festival customs	guest customs	education customs	childbirth customs
rural farming	Picking Experience	Fertilization Experience	Fishing Experience	Farming Experience	Harvesting Experience	Drying Experience
rural regimen	Leisure Walking	Sports Exercise	Medical Health Preservation	Swimming	Fitness Cycling Experience	Mountaineering Experience

Determine the themes related to rural tourism as vectors $\mathbf{L}$, where the vector elements are $L_{(1)}$ rural culture, $L_{(2)}$ rural cuisine, $L_{(3)}$ rural customs, $L_{(4)}$ rural agriculture, and $L_{(5)}$ rural health. Construct an interest feature vector as shown in equation (1).

$$\mathbf{L} = \{L_{(1)}, L_{(2)}, L_{(3)}, L_{(4)}, L_{(5)}\} \tag{1}$$

Quantify the vector $\mathbf{L}$ based on student scoring, and normalize each label element $L_{(i)}$ to constrain the label quantization value within the range of 0 to 1, facilitating the construction of a clustering objective function, where one vector represents the interest of one student. On the basis of establishing vectors $\mathbf{L}$, the closeness

function between vectors, namely the clustering function, is constructed by the spatial distance between vectors, as shown in equation (2), where a and b respectively represent two different students.

$$f(L_a, L_b) = \left\| \mathbf{L}_a - \mathbf{L}_b \right\|_2 \tag{2}$$

Using the clustering objective function to cluster students in a class, the clustering steps are as follows:

(1) Calculate the objective function $f(L_a, L_b)$ between two pairs of students;

(2) Find the k number of students with the lowest level of closeness as the seed points;

(3) Search for the points with the highest closeness with various seed points separately and include them in the cluster where the corresponding seed points are located;

(4) Repeat the above steps until the cluster state stabilizes.

For the constructed cluster, it contains one seed point and $m_{(i)}$ number of points with the highest closeness, where the letter i represents the No. i cluster. At this point, a cluster is formed, with students in each cluster having similar interests and hobbies, because in the clustering algorithm process, the selection of seed points has the feature with the largest discrete value, and each internal point has the feature with the smallest discrete value compared to the seed point. The cluster determined before the implementation of the practical course represents the class grouping, and the student corresponding to each seed point can be defined as the leader of the group. Other points within the cluster can be defined as other student members within the group.

III. CLUSTER GROUPING AND TEACHING IMPLEMENTATION EVALUATION

Evaluating practical course teaching is the process of evaluating the quality of organizing practical teaching for a course. For the practical teaching mode that uses clustering methods to group students, we need to evaluate the clustering process and also evaluate the implementation process of teaching organization.

Subjective and objective evaluation methods can be used to evaluate the generated class clusters for implementing student grouping in the clustering process. The subjective evaluation method relies on the experience and subjective judgment of students and teachers to evaluate the generated clustering results, mainly including the following aspects.

(1) Evaluate interest tags and vectors. Teachers and students score the set labels, with each student scoring each label on a scale of 1.0-10.0, with higher scores indicating better representation of student interests. Replace tags with low ratings.

(2) Measure the clustering score. The process of scoring interest tags by students needs to be supervised by teachers and supervisors, and the scoring platform should be used to monitor whether the scoring process meets the standards. For noise scores that do not meet the standards or have abnormal scores, they should be removed.

(3) Evaluate the clustering results. Teachers and students evaluate the grouping results together, check if there are any students who are dissatisfied with the grouping, and if there are any students who are dissatisfied with the grouping, identify the reasons for dissatisfaction and correct them in a timely manner.

The objective evaluation criteria include using the Rand index, mutual information score, contour score, etc. to evaluate the clustering results and determine the effectiveness and accuracy of the clustering results.

Secondly, evaluate the practical process. The practical teaching process can be evaluated through student peer evaluation. It is necessary to determine the discussion topic for each group based on the grouping results, and allow all groups to discuss for 10-20 minutes based on the topic. When the discussion is finished, a 5-minute report will be given in the order of the groups. During the reporting process, each group will score and the average score will be taken as the final score for that group.

IV. CONCLUSION

This paper is based on the reality that practical teaching accounts for a large proportion of higher vocational education course teaching. It constructs a method of using clustering model to achieve interest grouping of students in a class. This method utilizes clustering idea to gather students with similar interests into the same cluster, while students in different clusters have different interests. The process of constructing clusters follows rigorous mathematical rules, and the objective function is constructed through interest vectors to determine the degree of interest closeness among students, thereby ultimately determining the clustering groups. For the evaluation of clustering and practical process, this paper also conducts research, evaluating the accuracy of clustering through subjective and objective evaluation methods, and obtaining group scores via group peer evaluation in the practical teaching process. The method constructed in this paper is a highly feasible model for vocational education teaching, which can provide reference and inspiration for guiding the teaching practice in higher vocational education.

Conflict of interest

There is no conflict to disclose.

ACKNOWLEDGEMENT

The paper is funded by the Sichuan Ethnic Region Rural Digital Education Research Center, the project of "Research on Interactive Classroom Teaching Mode of Rural Education Teachers and Students Based on DIANA Clustering Algorithm"(No. MZSJ2004C11), The Education Information Technology Research for "14th Five Year Plan" in Sichuan Province, 2022, the project of "Research on Interest Driven Teaching Mode Based on k-center Genetic Clustering Algorithm"(No. DSJ2022253).

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