Design and Implementation of Teaching Assessment System in Higher Vocational Colleges Based on Association Rule Algorithm

Yunhua Liu(✉)

Marxist Institute, Hunan Communication Polytechnic, Changsha 410132, Hunan, China
hnjymy01@163.com

Abstract. The systematic assessment of teachers' classroom work is to adjust teachers' behavior, improve classroom quality, and then manage them well. This paper expounds the problems existing in the assessment of Higher Vocational Colleges in China; Taking the teaching management of higher vocational colleges as the background and teaching assessment as the research object, this paper discusses the design and implementation method of teaching assessment system under the environment of data warehouse. This paper attempts to build a decision support system for teaching management in Universities under the environment of data warehouse, which can first promote the improvement of teachers' personal teaching level, and then improve the overall teaching quality of the school. This paper discusses the design and implementation of teaching assessment system in Higher Vocational Colleges Based on association rule algorithm. In connection with the present condition and development requirements of assessment, and further combine their own situation, design a practical teaching assessment system with the participation of students, teachers, supervisors, educational administration managers, branch (workstation) teaching managers and experts, which can comprehensively and objectively evaluate the teaching situation of teachers, So as to promote the improvement of teaching quality.

Keywords: Teaching assessment · Association rule algorithm · Higher vocational colleges · System design

1 Introduction

For a long time, the whole society has a keen expectation for universities to cultivate high-quality talents, which makes universities regard improving teaching quality as the core work of universities. In recent years, with the continuous expansion of enrollment scale of universities in China, there have been a series of practical problems faced by universities, such as the decline of assessment quality [1]. Establishing a scientific teaching assessment system and assessment methods is an important means to strengthen the teaching management level and improve the teaching quality. Therefore, teaching assessment has always been an important part of teaching management in Universities.

M. A. Jan and F. Khan (Eds.): BigIoT-EDU 2022, LNICST 465, pp. 179–189, 2023.
https://doi.org/10.1007/978-3-031-23950-2_20

At current, our universities in China have carried out many exploration and research work in establishing and improving the teaching assessment system, and formed a variety of assessment models. Some universities use the method of filling in the teaching quality assessment card to collect data, and then the educational administration department makes statistics to determine the teacher's teaching quality assessment grade. In addition, most universities have realized the networking of teaching assessment with the help of campus network. Teaching assessment plays a role in supervising, monitoring and promoting teaching work [2]. However, there are also some problems that can not be ignored in the current teaching assessment:

(1) Ignoring the fundamental purpose of teaching assessment is to improve teachers' teaching professional level. Most university managers only link the assessment results with professional title promotion and teaching awards, but the role of teaching assessment in promoting the improvement of teachers' professional skills and teaching level has not been brought into full play.
(2) Ignoring the diversity of assessment objects, without comprehensive consideration of the characteristics of students, teachers and courses, the assessment calculation method is single, the formation method of assessment results is simple and lack of scientificity. Generally, the average score or standard deviation is simply obtained, and other implicit factors are not fully considered in the statistical process. It can not explain which factors the score is related to, but only reflect some aspects of teaching work [3]. Therefore, some teachers doubt the reliability and validity of the assessment and resist the teachers' teaching assessment.
(3) The accumulated teaching assessment data can not be used effectively for a long time. The traditional query and statistical methods deal with these valuable data, and can not predict the future development trend according to the existing data. In addition, due to the dynamics of the teaching process, some data are inconsistent. For example, the change of student status (grade repetition, professional transfer, etc.) and the change of teachers' professional title will affect the data analysis results due to the different data analysis time [4].
(4) Teaching assessment is a long-term work. At present, the teaching assessment work of most universities, from the assessment index system to the assessment work mode and process, is unchanged once established. It remains the same for several years, which is very unfavorable to the assessment work itself.

With the deepening of educational informatization construction in Universities, universities have gradually realized the importance of teaching assessment, and hope to apply modern information technology means to make teaching assessment apply to the teaching decision-making process of the school, so that teaching assessment can really improve the teaching level and give full play to its due efficiency [5]. Facing a large number of assessment indicators and a large number of data, how to separate and extract useful information from these data to provide support for scientific decision-making is an important research topic.

Nowadays, the important problems faced by the teaching quality assessment system in higher vocational colleges are the lack of application of modern scientific and technological methods and means, and the imperfect control mechanism and assessment

feedback [6]. The association rule algorithm in data mining technology can not only assist in the construction of teaching assessment system, but also realize the knowledge mining of teaching assessment data, Therefore, the design and implementation of teaching quality assessment system in Higher Vocational Colleges Based on association rule algorithm will be an important trend of educational science research, and has great practical significance.

2 Related Work

2.1 Data Mining

Data mining is a process of obtaining correct, novel, potential application value and ultimately understandable patterns from a large amount of data.The knowledge extracted from data mining should be expressed in many forms, such as concept, law, pattern, constraint, visualization and so on.

Data mining is produced by the development of information technology and the joint action of many factors. It is demand driven. Different from the previous complex data analysis methods, data mining is a kind of deep-seated data analysis methods. It is deep inside the data, and its special place is the ability to establish predictive models.

Data mining is an interdisciplinary subject involving a wide range. It brings together many technologies, such as database, mathematical statistics, artificial intelligence, visualization, parallel computing and so on. The powerful function of data mining is that it can automatically (or a small amount of manual intervention) find potential information patterns in a large amount of data, predict trends, and help enterprises build new ideas of operation and marketing [7]; Through data analysis, those seemingly unrelated things are actually related; Let users have more options to analyze and understand data, and let the data tell us more things.

There are many methods of data mining, among which the typical ones are association analysis, sequential pattern analysis, cluster analysis and so on. Different data mining methods have different application ranges, and the comprehensive application in reality can often achieve good results.

Cluster analysis: it is a method of studying “birds of a feather flock together”. It is a branch of multivariate analysis. At present, it has been widely used in the research fields of geology, psychology, biology, economy, image recognition, meteorology and so on. Cluster analysis is to determine the affinity relationship of samples by mathematical methods according to the attributes and characteristics of samples, and classify them naturally and objectively according to their affinity, so as to obtain a reasonable classification system [8]. There are many mature clustering analysis methods, such as system clustering method, dynamic clustering method, fuzzy clustering method and so on.

2.2 Association Rule Mining Technology

Association rules were originally proposed for market basket analysis. The development of bar code technology enables retail institutions to collect and store a large number of

sales records. Through the analysis of the accumulated sales data, the sales information of various commodities can be obtained. A large number of shopping basket data is an important basis and basis for marketing activities and business decisions. Through the data mining of shopping basket, we can find the relationship between different goods put into the "shopping basket", so as to know the shopping habits of customers, make more reasonable orders of various goods, and then reasonably control the inventory of various goods. In addition, according to the relevant conditions of various commodity sales, the sales relevance of commodities can be analyzed, so that the basket analysis and combination management of commodities can be carried out, which is more conducive to commodity sales.

(1) Basic concepts of association rules
Suppose L1, L2, L3 Is an item, $l = \{L1, L2, L3\ldots..$ Is a collection of items. There is a transaction database $C = \{D1, D2, D3, D4\ldots..\}$, Each transaction in the database $DL \in L$, $D2 \in L$, $D3 \in l$ Let $a \in L$, $B \in L$, and $a \cap B = \varphi$, The implication of $a \rightarrow B$ is the association rule on database C, the probability p $(a \cup b)$ is the support of association rule $a \rightarrow B$ in database C, which is recorded as support (AB), and the conditional probability p $(B \mid a)$ is the confidence of association rule $a \rightarrow B$ in database C, which is recorded as confidence (AB). If the minimum support and minimum confidence of association rule $a \rightarrow B$ meet the values set by the user, a can be called frequent itemset.

(2) Types of association rules
Association rules can be classified based on a variety of principles. For example, they can be classified based on the categories of variables processed in the rules, including Boolean and numerical types. The value processed by Boolean association rule is 0 or 1, which is convenient to explain the relationship between sub itemset A and sub itemset B in transaction set. Numerical association rules can be combined with multi-dimensional or multi-layer association rules to process numerical fields, dynamically segment them, or directly process the original data. Of course, numerical association rules can also contain category variables [9].

2.3 Common Algorithms of Association Rules

(1) Apriori algorithm
Apriori algorithm is a classic algorithm in association rule algorithm. Many scholars have improved and innovated Apriori algorithm in the future. The breadth first search strategy is applied in the algorithm. The steps to find all frequent itemsets are as follows: first, count all item sets with length of 1 to get frequent itemset K1, and then find out according to frequent itemset K1 In this way, the loop stops when a new frequent itemset cannot be found. The most important part of Apriori algorithm is to find frequent itemsets.

We agree as follows:

Each item in the transaction database is represented by $<$ itemid, itemname $>$, in which itemid is used to identify the corresponding transaction in the transaction database, and itemname is used to identify the corresponding item name in the transaction database. Use size to identify the number of items in each item set in

the transaction database; Lset is used to identify the item set with length L; LM is used to identify lset with minimum support, and LC is used to identify lset with the largest possible item set. The length of the initial item set is 1, so that the maximum length of the item set generated by the algorithm is 1. When looking for frequent itemsets in a loop, when the loop goes to step m, the first step is to use a specific function. We name it ITSC, generate the candidate itemset LC with the maximum itemset LM-1 generated in step M-1, and then calculate the support of the candidate itemset LC. Support is identified by lcsupp. The minimum support is identified by minisupp.

(2) FP growth algorithm

Apriori algorithm generates candidate item sets and then checks whether they are frequent. FP growth algorithm abandons the method of generating candidate sets by Apriori algorithm and uses the method of growing frequent sets (FP trees) to organize data. When searching the database, FP growth algorithm constructs the path of FP Tree to correspond to each transaction in the transaction database. Because the transactions in the database may have the same items, the path in FP Tree may also be repeated [10–14]. In this way, the effect of compressing information can be achieved through FP Tree. Because reading data from memory in the computer is much faster than reading from external memory, this can speed up the processing speed. FP growth algorithm includes two steps: one is to construct frequent pattern tree FP Tree, and the other is to call FP growth algorithm for frequent itemset mining.

(3) Partition algorithm [15–18]

The two algorithms described above are realized by scanning the database many times to find all the frequent item sets. If we reduce the scanning times of the database, we can not only reduce the 1 / 0 cost of the system, but also reduce a lot of computing costs.

Savasere proposed the partition algorithm in 1995. Its main concept is extended from Apriori algorithm. It is similar to Apriori algorithm in searching frequent itemsets and mining association rules. However, when mining association rules, Apriori algorithm will spend more time on the search of database, which is a great burden. In view of the shortcomings of Apriori algorithm, partition algorithm adopts the method of partitioning on the database to be mined, obtains all possible itemsets through the partitioned candidate itemsets, and calculates their support [19, 20].

The execution sequence of partition algorithm is as follows: firstly, the transaction database to be mined is divided into thousands of regions, and then these partitions are put into the memory of the computer for calling at any time. The algorithm is executed for each partition to generate the candidate set, and then the candidate item set of each partition is combined to calculate its support. If the support meets the requirements of the user, Is the frequent itemset you are looking for. The advantage of partition algorithm is that it only needs to retrieve the transaction database twice, which can greatly reduce the I / O overhead. However, there are also some problems: the partition algorithm can generate too many frequent itemsets for each partition after partition, When retrieving the transaction database for the second time, the time and storage space overhead of merging the frequent itemsets generated by each partition is too large. Another disadvantage of partition algorithm

is that the amount of computation will increase compared with Apriori algorithm. Moreover, the frequent itemsets generated by each partition may be repeated. In addition, the threshold of each partition needs to be adjusted after partitioning, which will also increase the candidate itemsets. In this way, additional expenses must be added for screening.

3 College Teaching Assessment System

3.1 The Role of College Teaching Assessment in Teaching Management

Curriculum assessment refers to the value judgment of curriculum content and process. Teaching assessment is to make a comprehensive investigation and value judgment on the overall or partial teaching system by using practical assessment methods and means according to a certain teaching purpose and teaching principle, and teaching assessment involves the assessment of teachers' classroom teaching quality.

Teaching assessment is an educational activity to judge the value of teachers' teaching process and results according to education and teaching objectives. It is based on the effective collection of data. Teaching assessment is an important link in educational activities (as shown in Fig. 1); It is also an effective means of teaching management and a research direction of education and teaching management.

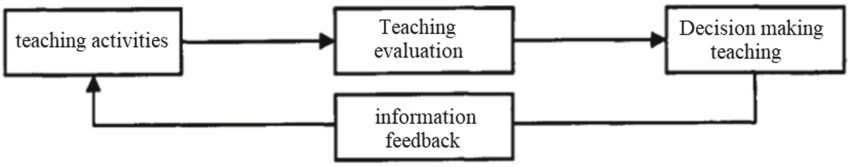

Fig. 1. Assessment block diagram

Teaching assessment plays an important role in the improvement of education and teaching quality. Teaching assessment is an important part of teaching monitoring. Improving the quality of education and teaching is also the core goal of teaching assessment:

(1) Teaching assessment is the basis of teaching monitoring management decision-making. Through the effective assessment of teaching activities, we can get a lot of information about the evaluated objects. After scientific and reasonable statistical analysis, we can find out the shortcomings in education and teaching work, clarify the improvement direction of teaching work, and provide a reliable basis for the decision-making of education and teaching work.
(2) Teaching assessment plays a guiding role. In the process of teaching assessment, the assessment index system and assessment results have a certain tendency. For example, in the assessment index system, the weight distribution of each index and the interpretation of the assessment results have pre value judgment, which plays a guiding role in some links or components of education and teaching.

3.2 Overall Design Objectives

The teaching assessment system is to meet the actual needs of the TV university system. Through the assessment of students, teachers, supervisors, educational administrators, branch (workstation) teaching managers and experts, it can timely understand the actual situation of teachers' teaching quality and provide scientific basis for improving teaching quality. The system has the characteristics of low cost, simple operation, high efficiency, easy maintenance and expansion. The flow chart of teaching assessment is shown in Fig. 2.

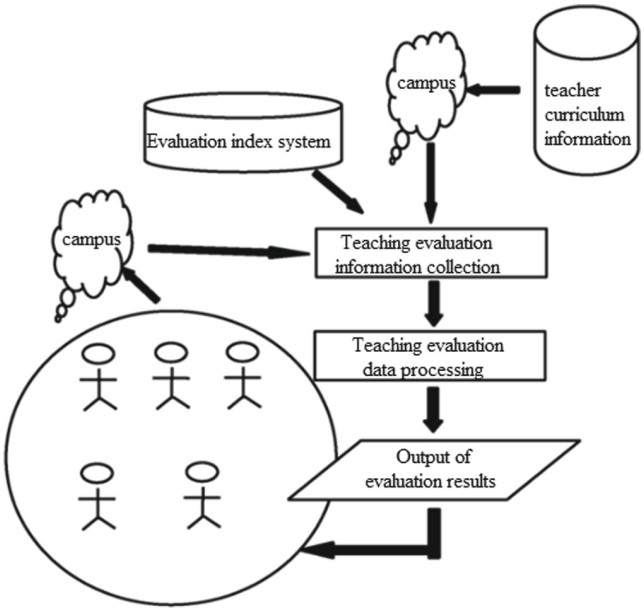

Fig. 2. Flow chart of teaching assessment

The system mainly includes six parts: system management, basic information management, assessment management, result management, result query and result printing. Among them, system management refers to user management. Users here include students, teachers, supervisors, educational administration managers, branch (workstation) teaching managers, experts, system administrators, etc. Basic information management mainly includes: basic information management of students, basic information management of courses, basic information management of teachers, basic information management of supervision, basic information management of educational administrators, basic information management of branch school (workstation) teaching administrators, etc. As shown in Fig. 3 below.

Assessment management mainly includes: student assessment management, teacher assessment management, supervision assessment management, educational administration management personnel assessment management, branch (workstation) teaching management personnel assessment management, expert assessment management,

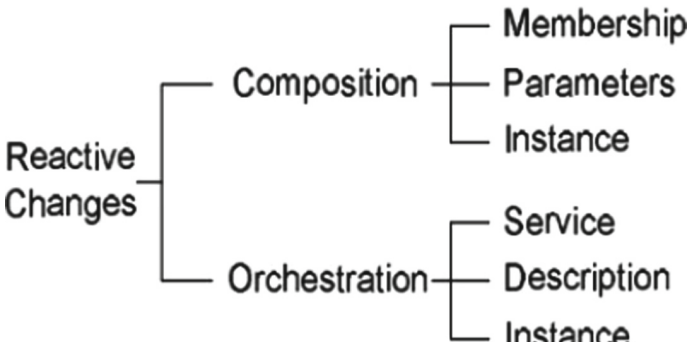

Fig. 3. Basic information management

etc. Result management mainly includes the result management of students, teachers, supervisors, educational administrators, branch (workstation) teaching administrators and experts. Result query refers to that various users can query the assessment results. Result printing refers to that various users can print the queried assessment results.

The goal of the teaching assessment system is to achieve the following:

(1) Through the assessment of all parties, timely and dynamically adjust the teaching methods and modes, so as to help improve the teaching quality.
(2) Ensure the openness, fairness and impartiality of the assessment through online assessment.
(3) Through online assessment, accurate assessment parameters, shorten the assessment cycle and improve work efficiency.

4 Design of Teaching Assessment System in Higher Vocational Colleges Based on Association Rule Algorithm

4.1 System architecture

In order to facilitate user access, the system adopts the three-tier structure of B/S model of web application. The three-tier (B/s) structure is formed by adding "web and application server" to the traditional two-tier (C/s) structure model. Its advantage is that the client only needs a browser to browse. Because the web requires to respond to the requirements of users, the network throughput should be large, the response speed should be fast, and the network stability should be good. Based on B/s, the three-tier architecture consists of presentation layer, business logic layer and data access layer. The architecture of the system is shown in Fig. 4.

4.2 System Function Structure

Developing any form of dynamic web system should follow the steps shown in Fig. 5.

The teaching assessment system developed in this paper also follows the same steps. Firstly, according to the requirements of different users, design functional modules,

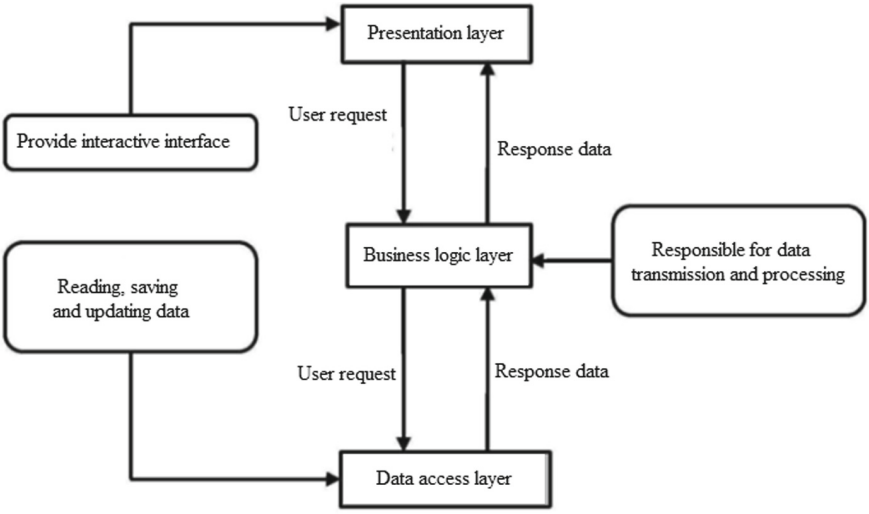

Fig. 4. System architecture diagram

layout the whole web page according to the functional modules, and each web page completes relatively centralized and independent functions. At the same time, consider the directness and convenience of user operation, and deal with the core contents such as the location and operation mode of different objects. Then, according to the design, write the corresponding script. It involves page development tools, dynamic page interaction technology, database selection and design and other important processes. Finally, test the system, debug each functional module, and complete the whole design and development process.

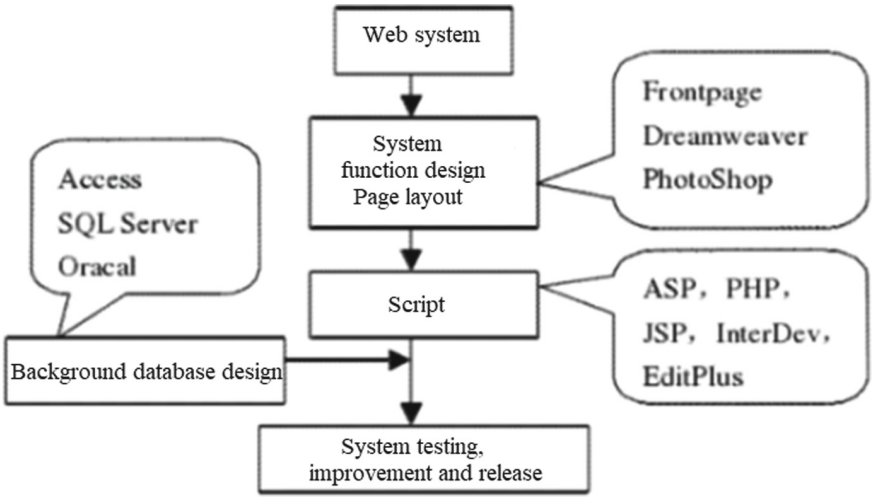

Fig. 5. Functional structure diagram of Web system

5 Conclusion

With the extensive development of assessment work in higher vocational colleges, the research on Assessment System in higher vocational colleges is more and more in-depth, and the application research of teaching quality assessment system based on association rule algorithm is paid more and more attention. This paper analyzes the implementation of teaching quality assessment system in Universities, This paper puts forward a new idea and a complete process of applying the association rule algorithm in data mining technology to the establishment and application of college teaching quality assessment system, and provides a scientific method for the implementation of the assessment system in Universities.

References

1. Sun, Z.: Design and implementation of teaching assessment system based on B/S Model. Comput. Appl. Softw. **23**, 2231–2243 (2012)
2. Huang, K., Wang, J., Xian, L., et al.: Design and implementation of teaching assessment system based on B/S. J. Chongqing Jiaotong Univ. (Natural Science) **45**, 1248–1256 (2012)
3. Design and Implementation of Teaching Assessment System Based on PHP+Apache+MySQL. **000**(015), 3456–3458 (2013)
4. Guo, J.: Design and Implementation of Automatic Assessment System in College English Writing Teaching Based on ASP.Net, pp. 1622–1626 (2021)
5. Tian, F., Zhu, Y., Li, Y.: Design and Implementation of Dance Teaching System Based on Unity3D. In: 2021 6th International Conference on Intelligent Computing and Signal Processing (ICSP) (2021)
6. Lin, H., Wei, Y.: Design and implementation of college English multimedia aided teaching resources. Int. J. Electr. Eng. Educ. **24**, 1131–1145, 002072092098351 (2021)
7. Cheng, L., Niu, W.C., Zhao, X.G., et al.: Design and implementation of college physics teaching platform based on virtual experiment scene. Int. J. Electr. Eng. Educ. **52**, 3348–3359, 002072092098468 (2021)
8. The Design and implementation of new engineering college students' intelligent assessment system for comprehensive quality. Comput. Sci. Appl. **11**(5), 1281–1290 (2021)
9. Wang, M.: Design and implementation of English composition automatic assessment system based on B/S architecture. In: 2021 13th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA) (2021)
10. Al-Aqbi, A., Al-Taie, R., Ibrahim, S.K.: Design and Implementation of online examination system based on MSVS and SQL for university students in Iraq. Webology **18**(1), 416–430 (2021)
11. Wambua, M.E., WaweruSamuel, N.: Constraints facing successful implementation of the competency-based curriculum in Kenya. Am. J. Educ. Res. **7**(12), 943–947 (2019)
12. Ningsih, S., Sigit, D. V., Lisanti, E.: Devepopment of multimedia based teaching materials to increase cognitive learning outcomes in respiration systems. Int. J. Eng. Technol. Manage. Res. **6**(7), 34–35 (2020)
13. He, Y.R., Wang, X.R., Chen, Q.J., Leng, P.: Design and implementation of virtual simulation teaching system for UAV based on WEBGL. ISPRS- Int. Archives Photogram. Remote Sensing Spatia Inform. Sci. 1239–1246 (2020)
14. Yichong, Z., Xiaoniu, L., Ke, Z., Chunhong, L.: Classroom learning assessment: modeling and tool design based on the SOLO classification theory. In: 2020 IEEE 2nd International Conference on Computer Science and Educational Informatization (CSEI) 2020

15. Liu, X., Dong, F., Tang, W., Yu, Z., Liu, X., Huang, M.: Reform and Implementation of Technical English Course for Brewing Engineering Undergraduates Based on STEAM Theory. Sheng Wu Gong Cheng Xue Bao = Chinese J. Biotechnol. **42**, 1128–1139 (2020)
16. Sun, Z., Anbarasan, M., Praveen Kumar, D.: Design of Online Intelligent English Teaching Platform Based on Artificial Intelligence Techniques. Comput. Intell. **37**(2), (2021). (IF: 3)
17. Xiang, H.: Design and function of teaching incentive mechanism of university teachers under the background of Big Data. In: 2021 International Conference on Internet, Education and Information Technology (IEIT), 2021
18. Wu, S.: Exploration and practice of the curriculum reform of real estate appraisal based on OBE education concept. In: 2nd International Conference on Computers, Information Processing And Advanced Education (2021)
19. Zhang, Q.: An Automatic Assessment Method for Spoken English Based on Multimodal Feature Fusion, Wireless Commun. Mobile Comput. **2021** (2021)
20. Said, R. R., Jamil, H.: The Analysis of Implementation and Scoring for KSSM Oral Assessment Among The Lower Secondary Teachers. Int. J. Acad. Res. Progress. Educ. Develop. (2021)