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Article

Construction and application of multimedia language Korean teaching database based on data mining

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Abstract: With the rapid advancement of modern technology, multimedia has become a transformative force in various fields, including language education. This paper explores the integration of multimedia technology and task-based language teaching methods in Korean language instruction, examining its impact on learning efficiency and instructional effectiveness. Drawing inspiration from biomechanical principles, this study analyzes the cognitive and physical interactions involved in multimedia-assisted language learning, focusing on how dynamic, interactive content can enhance students' comprehension and retention by considering the biomechanical aspects of motor skills used in speech production and language acquisition. By applying multimedia tools to Korean reading instruction, we aim to optimize learning processes in a manner that aligns with principles of cognitive biomechanics, such as task repetition, sensory engagement, and motor skill refinement. The proposed model leverages task-based approaches and interactive simulations to create a responsive and adaptive learning environment that considers the physical dimensions of language learning, such as articulation and phonetic accuracy. This integration of biomechanics-inspired educational design provides a framework for more effective, immersive language instruction, potentially setting a precedent for technology-enhanced learning across disciplines. By emphasizing the role of physicality in language learning, this research contributes to the understanding of how biomechanical factors can improve educational outcomes.

Keywords: biomechanics; multimedia technology; task-based language teaching; Korean language instruction; motor skills; cognitive engagement

1. Introduction

With the continuous development of society, the demand for Korean language proficiency has significantly increased, especially within the context of growing economic, cultural, and educational exchanges between China and South Korea. Consequently, many universities in China have established Korean language programs, aiming to cultivate talents with comprehensive Korean language skills, including proficiency in Korean history, economy, culture, and literature [1–3]. In this context, Korean education in Chinese universities not only addresses linguistic skills but also serves as a platform for fostering international understanding and collaboration.

In recent years, the integration of multimedia technology into language education has revolutionized traditional teaching methods, facilitating diverse resources and interactive environments for language acquisition. Multimedia technology, incorporating text, graphics, images, animation, sound, and video, has been instrumental in enhancing the resource environment for Korean language instruction, thus boosting both teaching efficiency and learning effectiveness [4–7]. Various Korean language learning platforms have emerged, providing resources for online

learning, testing, and interactive Q&A sessions, which have become crucial tools in building an efficient and engaging learning atmosphere [8,9]. These platforms allow for seamless sharing of teaching materials, promoting student interest and enhancing teacher-student interaction, thereby creating a dynamic and harmonious educational environment [10].

In addition to multimedia integration, effective vocabulary instruction is essential for Korean language learning. Korean vocabulary is complex, often involving nuanced morphological and semantic variations, and presents challenges for students, especially with onomatopoeic and symbolic words that differ significantly between Korean and Chinese [11,12]. Previous studies have explored various aspects of vocabulary instruction, including task-based language teaching methods. Dong [13] emphasized the student-centered nature of task-based teaching in Korean, highlighting its effectiveness in improving student engagement and practical language skills. Other researchers, such as Li and Pan, have pointed out the importance of integrating cultural education and understanding linguistic similarities between Korean and Chinese, which can facilitate Korean language learning for Chinese students [14,15].

Furthermore, comparative studies have played a crucial role in understanding the similarities and differences between Korean and Chinese languages. Garone [16] and Jian [17] explored various linguistic features, such as reduplicated words and symbolic expressions, which are prevalent in both languages due to shared cultural interactions. Zhao [18] and Piax [19] provided macro and micro perspectives on language comparison, which offer valuable frameworks for understanding the influence of social, linguistic, and cultural factors on language learning. Wang [20] and Vanesa [21,22] analyzed semantic features of onomatopoeic words across languages, further contributing to the body of knowledge on cross-linguistic comparisons.

This paper builds on this body of research by focusing on linguistic elements like homographs, onomatopoeias, quantifiers, symbolic words, and reduplicated words, providing insights into effective Korean vocabulary teaching strategies [23]. Additionally, this study explores the combination of multimedia technology with task-based language teaching, specifically in Korean reading instruction. By leveraging a visual feature reconstruction model, the paper also addresses the broader context of balancing linguistic, cultural, and environmental factors in urban development, an aspect relevant to the integration of technology in education. The unique combination of these elements aims to offer a comprehensive framework for Korean language education that is adaptable to modern technological advancements, ultimately enriching the learning experience and fostering cross-cultural understanding.

2. Methodology

2.1. Multimedia language construction based on data mining

The use of data mining technology can make the resource system understand the meaning contained in the user interaction behavior data, so this technology can be widely used in personalized/recommended services, resource optimization/system adaptation, information service intelligence, system traffic analysis, etc. The domain intelligent teaching system uses data mining technology to analyze teachers' teaching strategies, as well as students and their learning process. The results of the analysis are

used to adjust teaching strategies, rationally set courses, and personalize students' teaching.

2.1.1. Construction of teaching database based on data mining

The teaching system based on data mining is developed by Browser/Server (B/S) mode. B/S mode is widely used, and it is the mainstream of software development today. Its characteristics of emphasizing server over browser make most of the work done on the server side, so long as the browser software is installed on the client side. This mode has the characteristics of installation free, easy to use, simple maintenance, cross platform and convenient software upgrade. For these advantages of b/s mode, combined with the actual needs of the teaching system, the model of. system is based on b/s mode. The system has a total of three-tier structure.B/S mode construction systems are: user interface layer, WEB server layer and resource layer.

2.1.2. Calculation process of data mining algorithm

(1) Text data collection. Determining the data source and obtaining the corpus is generally the first step in text data mining. Currently, the required data is usually obtained in the form of capturing network data. (2) Data preprocessing. Due to the huge number of online comments and unstructured data, the comment data collected by web crawler technology can generally meet the requirements of quantity and topic relevance, but cannot make the initial data machine readable. (3) Text feature mining. This is the main link in the process of data mining. Using neural network, machine learning, data analysis and other related technologies, we can mine the key elements such as product features, comment opinions and user emotions implied in the review text, and realize the classification, clustering and correlation analysis of the text topics. (4) Display of visual results. Usually, visual tools are used to display the data analysis results in graphs, charts or interfaces, highlight the data value, make the data results easy to communicate, and make them more vivid and friendly, so that the key information conveyed by the research results can be more intuitively felt.

2.2. Multimedia language model based on data mining

Korean is a language with strong practicality. In the process of teaching Korean, we should pay attention to the application of Korean, so as to cultivate outstanding Korean talents for the society. Under this background, colleges and universities also attach importance to the establishment of Korean teaching resource platform, and integrate and share Korean teaching resources by effectively combining with computer network, so as to provide more resource channels for Korean professionals. Data mining is a process of finding hidden, potential and useful knowledge for us from a large amount of collected data. The biggest advantage of introducing data mining technology into the teaching system is that it can analyze a large amount of collected data in the system, and mine useful information such as the presentation of course content and the adjustment of teaching strategies, so as to build a rich, easy to operate, distinctive A relatively intelligent teaching platform. The teacher user system mines and analyzes the data gathered by the students it teaches, and provides the analysis report of the students' learning situation and online teaching suggestions. Teachers can adjust the difficulty of teaching content and the allocation ratio of teaching resources of various teaching types according to the overall situation of students, and

can also use various forms of communication for some special students to stimulate their enthusiasm for learning and adjust their learning status in time. As shown in **Figure 1**.

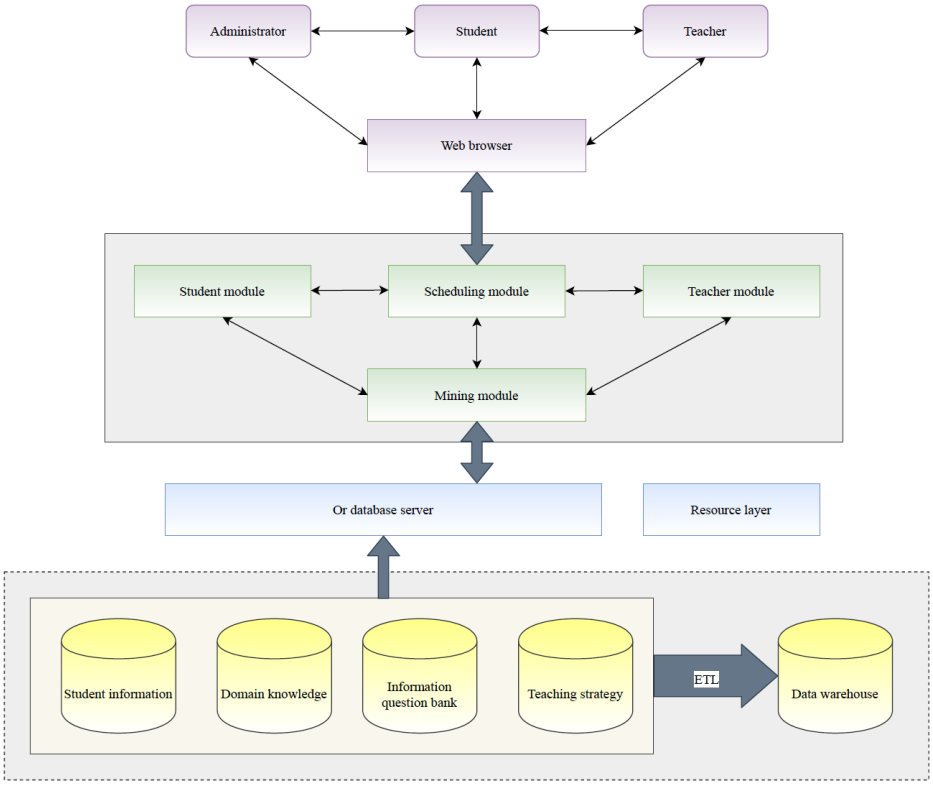

Figure 1. Teaching system model based on data mining.

Data mining is an interdisciplinary subject involving artificial intelligence, database, statistics, etc., and it has always been a hot research topic by scholars at home and abroad. It can be applied to various information management systems and decision support systems to provide support for users' decision-making. The content of data mining includes the following aspects: classifying data sets, analyzing the internal association rules of data, discovering outliers, discovering available sequence patterns, analyzing the interdependence between data, etc. Data mining is a complex system with multiple modules working together. The architecture of the data mining system is shown in **Figure 2**, including database, knowledge base, data mining engine, pattern evaluation and user interface. (1) Database; (2) Database server; (3) Knowledge base; (4) Data mining engine; (5) Model evaluation; (6) User interface;

BPNN algorithm has outstanding characteristics, good self-learning ability and nonlinear mapping ability, which can promote the construction of multi-input and single-output landscape ecological construction and spatial pattern analysis model. At the same time, with the application of this algorithm, if unknown sample data is added to the network in the subsequent error compensation process, the network can still be correctly mapped from the input space to the output space. According to various causes of errors in spatial pattern analysis, the mathematical model is constructed:

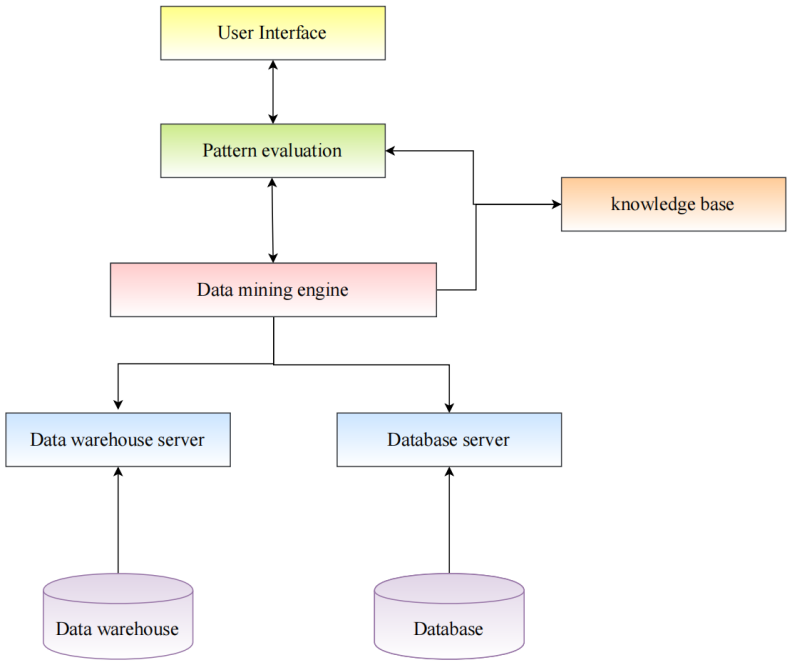

Figure 2. Data mining system.

The classification algorithm of data mining is to mine and analyze the classification rules according to the training data set, then classify other data of the same type, and provide valuable guidance for business systems. The processing flow of the classification algorithm can be roughly divided into the following steps:

(1) Select a representative and relatively complete training data set whose data structure should be exactly the same as the target data set. Each record in the training dataset has a corresponding type identifier.

(2) Mining and analyzing the training data set, calculating the feature value of each record, so as to generate each type of classification rules. This rule cannot be achieved overnight, and requires repeated testing, adjustment, and optimization until it meets the requirements.

(3) Classify the target data set according to the classification rules and generate useful guiding rules.

in order to describe ID3 algorithm more clearly, Then the entropy of a, that is, the expected value equation, can be expressed as: let A be the training data set, M be the number of categories in the training data set, the number of categories in the training data set, and the probability that any data belongs to a category.

$$\text{entropy}（A） = -\sum_{i=0}^{m} p_i \quad \log_2 p_i \tag{1}$$

If attribute e divides training data set a into N parts,A_i is the ith subset of training data set, and $|a|$ and $|A_i|$are the number of training data set a and its subset, A_i then the entropy of these divided subsets, that is, the expected value equation, can be expressed as:

$$\text{entropy}\left(A,E\right) = \sum_{i=0}^{m} \frac{|A_i|}{|A|} \text{entropy}\left(A_i\right) \quad (2)$$

Then the training data set a is divided by attribute e, and the information gain of the reduced entropy obtained is the difference between the UN divided entropy and the divided entropy. Gain $(A,E) = \text{entropy}(A) - \text{entropy}(A,E)$. The greater the information gain, the more classified information provided by the selected partition attribute, because entropy is a measure of data diversity. If the information gain is small, it indicates that the classification attributes lack diversity, and the attributes can provide less classification information, so it is not worth being classified as attributes.

2.3. Implementation of Korean teaching database model

According to the entries included in the Korean Mandarin Dictionary, there are about 160,000 words in total. Because words are uncertain during query, they are all transferred into memory, which is relatively large. The storage of words belongs to the storage of big data, so from the beginning It is necessary to design a better solution. If the simple text storage does not need to take up a lot of space, the subsequent data expansion, such as adding example sentences, translations, related phrases, example sentence sources and other data, will be messy. It is very difficult to read the data. In the process of Korean teaching resource platform, the main operating environments are as follows: media server, Web server and address server, which are the main channels for customers to execute commands. When customers use computers to input commands, the server can save the customers' commands into the database, and then return the results to the server after the computer performs operations, and finally send them to the customers. in the Korean teaching resource platform, it also tests the ability of platform management staff and resource management. It mainly includes the following contents: search, query, modification and management. The most important content in the platform of managing Korean teaching resources is teaching resources, which covers a wide range and a wide variety, and can provide students with high-quality teaching content, such as auxiliary articles and videos related to the content. For example, in the process of teaching "Comprehensive Korean", two factors, "must use" and "sufficient use" should be mainly considered when selecting resources, so as to better realize the effective integration of teaching and practice. The role of database design in a system is very important. Whether the database is established or not directly affects the realization of the system.

The design of database should not only meet the needs of users, but also reduce the redundancy of data as much as possible, reduce the dependence between data as much as possible, and separate them, and require the database structure to fully meet the output and input of all kinds of information. Considering merging association rules *R1* and *R2*, it is possible that the left and right parts of the two rules are the same or similar, or the left or right sides of the two rules can be merged, or the difference in their support and confidence is very small. Considering that the attributes on the left and right sides of the two rules are the same and the attribute values are similar, the two rules can be merged into one. (URL = 2.2, 20 < Study Time < 40), then the

equation for calculating the support of the new rule r according to the rules r_1 and r_2 is:

$$S\ （r）= \frac{s(r_1) \times bdsize(r_1) + s(r_2) \times dbsize(r_2)}{db\_size(r_2) + db\_size(r_1)} \tag{3}$$

The calculation equation of support degree on the left side of the new rule is:

$$S\_1hs(s) = \frac{s\_lhs(r_1) \times db\_lhs(r_2) \times db\_size(r_2)}{db\_size(r_2) + db\_size(r_1)} \tag{4}$$

The equation for calculating the confidence of the new rule r according to the rules $R1$ and $R\psi$is: complete and healthy vocabulary can provide a reliable basis for statistical research, and on this basis, various classification dictionaries can be made, such as classification according to parts of speech, certain elements in form, number of syllables and frequency of use.

$$confidence(r) = s(r)/s\_1hs(r_1) \tag{5}$$

$$N_{EC}(T_{i1}) = N_C(T_{im}) + m \tag{6}$$

$$N_{EC}(T_i) = N_C(T_{im}) + m \tag{7}$$

Combining Equations (6) and (7), we get

$$N_{EC}(T_{i1}) = N_{EC}(T_{i1}) \tag{8}$$

If $L_C(T_{i1}) < L_C(T_{j1})$, then $N_C(T_{i1}) > N_C(T_{j1})$, we can get $N_{EC}(T_{i2}) > N_{EC}(T_{j2})$. Therefore, $N_{EC}(T_{i2}) + 1 > N_{EC}(T_{j2}) + 1$, namely

$$N_{EC}(T_{i1}) > N_{EC}(T_{i1}) \tag{9}$$

$$N2_{EC}(T_i) = N1_{EC}(T_i) + 1, N2_{EC}(T_j) = N1_{EC}(T_j) + 1 \tag{10}$$

Therefore, we need to interpret and store the vocabulary. For the storage of data, we need to design a specific file storage format. After research, the technicians finally produced the following format. As shown in **Table 1**.

Table 1. Storage format of a certain entry *N*.

Attributes	Secondary attribute	Tertiary properties	Four-level attribute	Type of data
Basic properties	Record	None	None	Text
	Entry content			Text
	Part of speech			Text
	Structure			Text
	Pronounce			Text
	Generic			Text
	Corresponding Chinese characters			Text
	Synonym			Text
	Antonym			Text
	...	...	...	...

Table 1. (*Continued*).

Attributes	Secondary attribute	Tertiary properties	Four-level attribute	Type of data
Extended property	Korean interpretation	Item 1		Text
		Item 2		Text
		Item 3		Text
		Item 1	....	Text
	Chinese explanation	Definition 1 (text array type)	Explanation, example, translation	Text
		Item 2	Explanation, example, translation	Text
		Item 3	...	Text
		Item N	...	Text
Related phrases	(Optional)			

Of course, according to the needs, you can add more attributes to the basic attributes, and you can also extend them to the secondary and tertiary attributes. On the basis of four-level attributes, five-level attributes are made, for example, the' example' is expanded into an array form, thus providing the possibility for subsequent data expansion. The current four level attribute limits that an interpretation of a semantic item can only carry one example sentence and translation. Limits subsequent expansion. The production of this file format is the platform for future input work, and all data will be stored in the above way.

If the above data is directly listed and stored on the medium without standardization, it will be futile. Because the data will be read again in the future, and there may be requirements for editing again. The author finally produced the following specification format: as shown in **Table 2**.

Table 2. Specification format.

Data level	level name	Data start	End of data
1	Entry level	Data	/Data
2	Basic attributes, extended attributes, related phrases	Base	Base/
3	Meanings	Means	Means/
4	Different interpretations	Mean	Mean/
5	Example sentences, translations, interpretation of texts	Exa	Exa/

Of course, you can change the identifiers of the beginning and end of the data according to your needs. This kind of markup is similar to HTML Markup Language (Hypertext Markup Language), which has a good control ability for storing a large amount of multi-level data. Therefore, it is more appropriate to use this method for the data files of Korean dictionaries. It is beneficial to update data in the future. the system is designed with technology and. from the perspective of data organization, it includes functions such as data management, data classification and data browsing; from the perspective of data processing, it includes functions of data storage, data processing and data query; from the perspective of data structure, it can also handle data

relationships to a certain extent, mainly realizing the establishment and query of multimedia data relationship diagrams.

3. Result analysis and discussion

In the experiment, the size of the scheduling window is fixed to 32, that is, each scheduling must be the first 32 queries in the query queue before they can be scheduled to be executed. Test the impact on each scheduling algorithm when the number of processing nodes is 16, 32, 64 and 128 respectively. As shown in **Figure 3**.

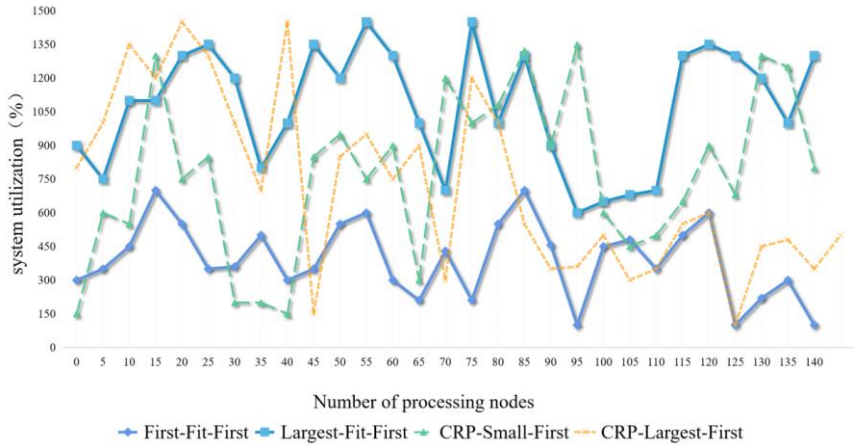

Figure 3. Number of processing nodes and system utilization.

To understand the impact of the size of the scheduling window on the system efficiency, the number of processing nodes is fixed at 32, and the size of the scheduling window is changed, before task scheduling, we need to determine the task scheduling order. HEFT defines rank(n) as the priority of task n. from the perspective of data organization, it includes functions such as data management, data classification and data browsing; from the perspective of data processing, it includes functions of data storage, data processing and data query; from the perspective of data structure, it can also handle data relationships to a certain extent, mainly realizing the establishment and query of multimedia data relationship diagrams. The experimental results are shown in **Figure 4**.

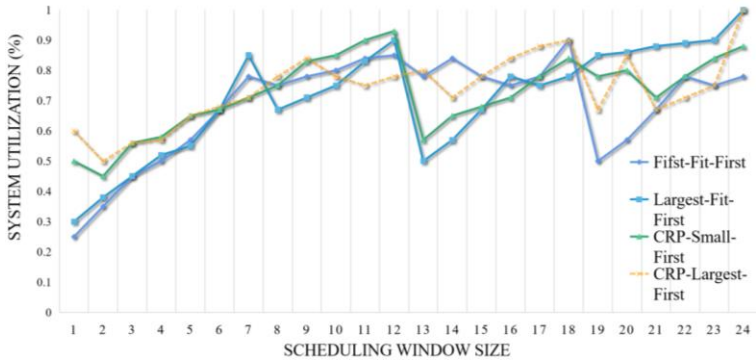

Figure 4. Scheduling window and system utilization rate.

As can be seen from the experimental results in **Figure 4**, finally, according to the scheduling order of heft algorithm, these tasks are 4, Now an explanation has been

added to the text as follows: sorting has a good effect on the execution of tasks, which can save the system identification time. The system utilization of the four scheduling algorithms all show an upward trend with the increase of the window size. This is because with the increase of the window size, the scheduling has more and more query selection space, and a better query combination can be found. Comparing the advantages and disadvantages of the four scheduling algorithms, it is found that CRP_ Largest_ First has the highest efficiency, and the system utilization rate is even as high as 99% or more, that is, all processing nodes can be used in most cases, and there are few idle processing nodes. In the experiment of this section, the number of processing nodes or the size of scheduling window are changed synchronously in the ratio of 1:1, so as to explore their influence on the four scheduling algorithms. The experimental results are shown in **Figure 5**.

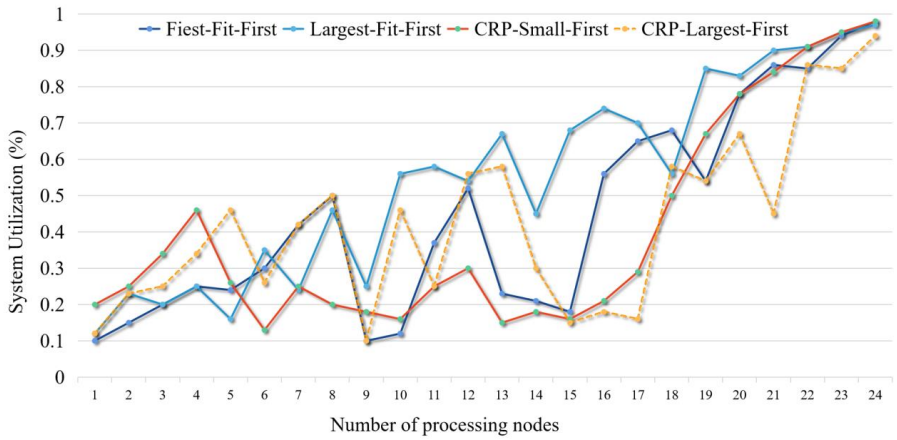

Figure 5. Synchronization of number of processing nodes and size of scheduling window New Year call and system utilization.

It can be seen from **Figure 6** that when the transaction record is appropriately large, the efficiency of the optimized algorithm is higher than that of the classic Apriori algorithm, which shows the efficiency and availability of the optimized algorithm performance. As shown in **Figure 6**.

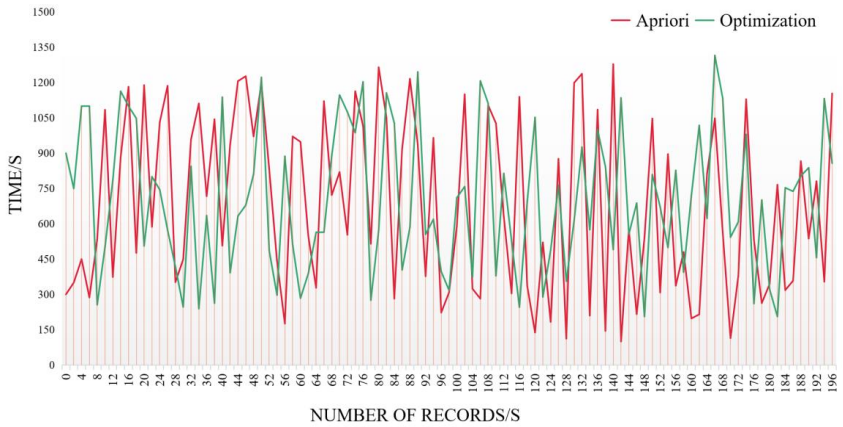

Figure 6. System physical structure.

The test bank management subsystem is composed of 20 modules and 20 pages. According to the requirements of Korean Basic course, the types of test questions are

single choice, reading comprehension and judgment questions. Each test question contains several knowledge points, and individual test questions contain multimedia content such as listening content or pictures. In order to facilitate the recording of knowledge points contained in the test questions during the writing of the test questions, the session management technology is adopted, that is, the sequence of knowledge points contained in the test questions is saved in the form of "key value" in the object, and the sequence of knowledge points stored in the object can be easily accessed on the test question publishing page and the test question modification page. The research of language is often inseparable from the construction of corpus, and the generalization of the laws of language research is very dependent on the actual situation of the first-hand corpus, so the construction of the database is a necessary premise, this process requires technical personnel, language research. The process of cooperating with people, staff, etc.

4. Conclusions

With the research and development of language teaching theory, the teaching concept of "learner-centered" has been emphasized in the teaching of such courses, and the importance of virtual reality environment in language teaching has gradually been revealed. As a network teaching system, its main function is to assist teaching, and let students study by reviewing or self-study after class. the system is realized in the form of animation, which is vivid, informative, interactive, beautiful and practical. After use, it is well reflected in teaching. Teachers and students believe that the system can play a role in assisting teaching and improving teaching effect. At the same time, the scalability of the system also saves the development cost for subsequent courses. Following the development and progress of language and literature, the development of language and literature is relatively prominent, and the friendly exchanges between countries and countries also run through the language exchanges between the two countries. From the single language at the beginning to the gradual increase in the distribution of various countries in the world in later generations, the characteristics of language complexity and diversity have become more and more obvious. It breaks the traditional mode of relative isolation and brings countries together. With the influence of the globalization of the world, contrastive linguistics has been paid more and more attention by scientists and scholars in various countries. Because of the rising international status of China and South Korea, the comparative study between China and South Korea has also attracted attention in international hotspots. Chinese and Korean contrastive linguistics has promoted the political, economic and cultural exchanges between China and South Korea, and the international community has also warmly responded that China and South Korea can become partners. This trend is bound to lead to the prosperity of the Chinese and Korean language teaching community and the Chinese and Korean language teaching community, as well as the growth of the translation and publishing community in China and South Korea. In a word, the establishment of Korean teaching resource platform has brought more convenient and efficient resources to students majoring in Korean. At the same time, it has also enhanced the level of Korean teachers' lesson preparation, enhanced students' Korean learning ability to a certain extent, and played an important role in

the development of Korean Teaching. In the process of teaching Korean, major colleges and universities have established a sound resource platform based on the actual situation. On this basis, they have effectively expanded and managed to further realize the sharing of Korean teaching resources, gradually improve the Korean language teaching resources, and then improve the learning effect of Korean.

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Conflict of interest: The author declares no conflict of interest.

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