





Optimization of Computer-Assisted Vocabulary Assessment System in International Chinese Language Teaching

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Abstract. Vocabulary assessment occupies an important position in Chinese language learning, but traditional vocabulary assessment has many limitations in terms of feedback time, efficiency, quality and effect, while computer-aided assessment, with its advantages in statistical analysis and organization and management, has become an effective means to compensate for the inadequacies of traditional vocabulary assessment. Based on the current development of international Chinese language education, this paper proposes a computer-aided Chinese language assessment system based on the problems of insufficient feedback and simple feedback functions in Chinese language assessment, and uses vocabulary assessment as an example to develop the system. In this paper, the current status and development of Chinese as a second language assessment, vocabulary assessment and computer-assisted Chinese language assessment are reviewed. It is pointed out that it is necessary to build a computer-assisted Chinese vocabulary assessment system with "strong feedback" function for Chinese teaching in order to improve students' Chinese learning and teachers' work efficiency. The design of a computer-assisted Chinese vocabulary assessment system is proposed, and the design objectives, functional framework, assessment procedures, methods of Chinese vocabulary assessment, and the form and content of feedback are explained. In this paper, an application survey of the evaluation system is conducted to verify the system's role in promoting Chinese learning.

Keywords: international Chinese language teaching; vocabulary assessment; computer aided; system optimization.

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1 INTRODUCTION

International Chinese language education is developing very rapidly. Many countries and regions have included Chinese as a compulsory or optional subject, and many countries and regions have established Confucius Institutes and Confucius Classrooms. Many countries and regions have established Confucius Institutes and Confucius Classrooms. Under the influence and impetus of the Confucius Institutes of the Office of the Chinese National Leading Group for the Promotion of International Chinese Language, the number of Chinese learners around the world has reached more than 50 million, and international Chinese language education is going on as fast as ever [1]. Chinese teachers and Chinese learners are all looking for a better way to teach and learn Chinese [2]. The research on teaching Chinese as a second language has been further intensified and the subjects of research have become more diversified. Chinese language assessment is one of the research topics that have attracted much attention [3]. Cuiling proposed that computer-aided assessment can provide instant feedback [4]. Learners in the practice or test, as long as the input data that can get feedback from the system, instantly know the correctness and mastery of the situation, to facilitate learners to keep abreast of their learning progress, the formative assessment has a great advantage over traditional assessment. Rapid and immediate access to personalized feedback is one of the biggest advantages of computer-assisted assessment [5]. Carbajal found that the quality of feedback in traditional assessments depends on the level of the teacher, whereas computer-assisted Chinese language assessment systems have built-in feedback systems so that each learner can receive the same standard of feedback [6]. It is recognized that non-item factors in the assessment process influence the results. Computers can track the whole assessment process and collect assessment data, such as the time of the test, the order and number of questions, and whether the participant has changed his or her answers, etc. Lu said that these factors can be incorporated into the evaluation to improve the validity of the assessment. A computer-aided assessment has enormous advantages over traditional assessment and is the future development direction of assessment, as well as a key topic in the Chinese language assessment research field [7].

Li proposed that vocabulary assessment occupies an important position in Chinese learning, but traditional vocabulary assessment has many limitations in terms of feedback time, efficiency, quality, and effect, while computer-aided assessment, with its advantages in statistical analysis and organization and management [8]. John found that it has become an effective means to compensate for the inadequacies of traditional vocabulary assessment. Therefore, this paper intends to conduct a study on computer-assisted Chinese vocabulary assessment [9]. By analyzing the existing literature and research results on Chinese as a second language assessment, domestic and international vocabulary assessment and computer-assisted Chinese vocabulary assessment, this paper summarizes the necessity and feasibility of constructing a computer-assisted Chinese vocabulary assessment system. Based on the actual Chinese vocabulary assessment and learners' needs, this paper proposes a system design and determines the functions of the system and each module [10]. Agarwal uses computer technology to implement a preliminary computer-assisted Chinese vocabulary assessment system and to debug and optimize the system [11]. Moorkens organized foreign students and teachers to try out the system and analyzed its application to test the results and point out the direction for further research [12].

2 CHINESE VOCABULARY ASSESSMENT SYSTEM IN INTERNATIONAL CHINESE LANGUAGE TEACHING

2.1 Chinese Vocabulary Assessment System Design

The spelling error correction algorithm based on the N-Gram language model is the method proposed for solving spelling errors in this thesis and does not deal with deeper grammatical

errors, so this section only sets up a set of comparison experiments, i.e., it is compared only with the results of the Computational Linguistics Research Center. A practical and valuable vocabulary assessment system can only be designed and built with a good understanding of the needs of system users and guided by clear objectives. From the above review, it can be seen that the current vocabulary assessment has the following shortcomings: First, teachers and students receive little feedback and the feedback is not effective. The traditional vocabulary assessment method only gets a score, which can only understand the general level of students, but there is no way to know the mastery of the specific knowledge behind the score. Second, the traditional vocabulary assessment is inefficient. Designing vocabulary items, evaluating questions, and analyzing the test results often consumes a lot of teachers' energy and makes it difficult for teachers to give immediate feedback to students. Therefore, there is an urgent need for a Chinese vocabulary assessment system with automatic assessment and scientific feedback functions, to reduce teachers' burden, improve teaching efficiency and effectiveness, and meet the needs of the further development of international Chinese language education. Administrators can manage and maintain the system and can view and modify teacher, student, and question bank information. The functions of each module of the system can be expanded, and other types of questions can be added as required, so it has good expandability. The system can be expanded to meet the needs of other types of Chinese language assessments besides the Chinese vocabulary assessment. There are three types of users of the Chinese Vocabulary Assessment System, namely students, teachers, and system administrators. Students can use the system to take self-assessments and get feedback on their learning to improve their learning. Through the system, teachers can understand the vocabulary mastery of their students, create their question banks, organize exams for students, and improve their work efficiency. The administrator has the highest authority to manage and maintain the system for students, teachers, and question banks. The functional framework of the Chinese vocabulary assessment system is shown in Figure 1.

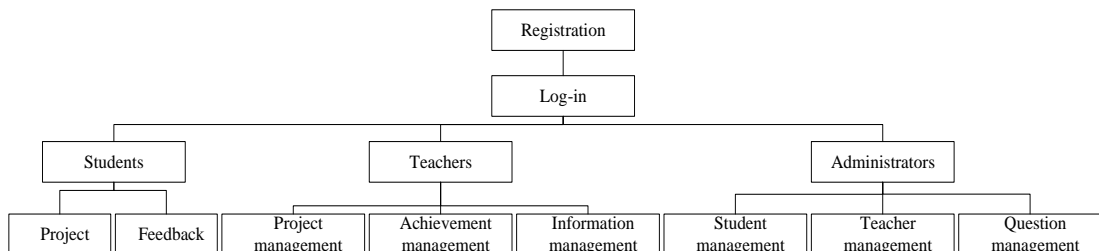


Figure 1: Functional framework of the international Chinese vocabulary assessment system.

To achieve the above functions, the system will be divided into the following five modules, namely, the registration module, the testing module, the evaluation module, the feedback module, and the management module. There are three kinds of users in the system, i.e., administrators are students, teachers, and administrators with built-in accounts. Administrators can add or modify the information and permissions of student or teacher users. Student users can register on their own, and their registration information includes name, class, password, native language, and Chinese level. Teachers can register on their own, and their registration information includes name, class, and password, but they need to be verified by the administrator before they can have relevant permissions. On the login page, you can select your identity and enter your name and password. After logging in, students can take a test on a particular lesson or unit of vocabulary and get assessment results, or view their previous assessments. Teachers and administrators can view individual student feedback pages in addition to class performance analysis including common metrics such as average, highest, lowest, and standard deviation to adjust instructional methods and strategies. The Student Performance Management function can be used by users with

administrative privileges to view individual student performance and class analysis after logging in. Class performance analysis includes the highest, lowest, average, and standard deviation scores. User management privileges are only available to system administrators, including adding users and modifying user information.

The question bank is a sub-module of the management module for topic management, and its functions include topic entry, query, modification, analysis, and composition. After logging in as a user with question entry privileges, you can select Question Entry in Question Management to perform question addition operations. The attributes of the recorded questions include question type (required), question stem (required), answer (required), corresponding knowledge point, error analysis, difficulty, differentiation, cognitive classification, course, and unit. After logging in as a user with question search privileges, you can use the question search option in question management to perform a question search. The question lookup can be done by keywords such as course, unit, question type, difficulty, differentiation, cognitive classification, entry time, entrant, and question number.

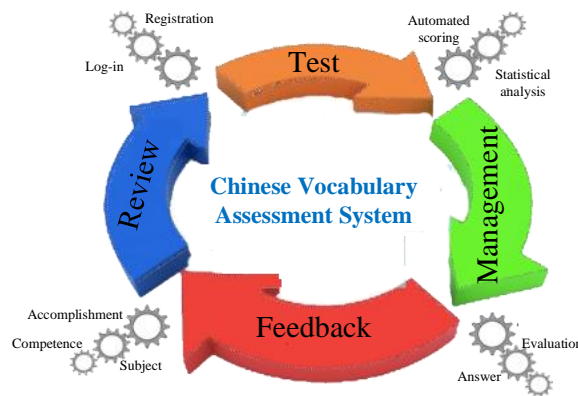


Figure 2: Components of Chinese Vocabulary Assessment System.

The process of computer-assisted vocabulary assessment can be divided into the following parts in Figure 2. The construction of vocabulary assessment resources (question banks), using text, sound, charts, images, video and animation, and other multimedia technologies to build vocabulary assessment resources, presented to the assessor in a more humane and close to the physiological and psychological needs of learners, to build a good assessment environment for learners close to the real-life communicative situations. Through natural language processing technology, including Chinese characters, speech recognition, and other data processing technology to identify the data entered by the learners, converted into a form that can be understood by the computer. Automated assessment, also known as Computer Automated Scoring (CAS), is a computer simulation of the process of manually scoring items (both objective and open-ended) and skills, operations, and expressive activities. Feedback content can guide student learning and help teachers improve instruction and adjust goals. The assessment results are processed through multimedia technology and presented to users in a variety of targeted formats. The design and construction of feedback content is the research focus of computer-assisted vocabulary assessment.

2.2 Vocabulary Assessment Content and Methodological Design

The tasks are presented in chunks, in order, and only when you complete one part of the test can you move on to the next. The way to complete the tasks is mainly by clicking and dragging, which is convenient for computer and mobile terminal operation. The layout of the page is mainly

centered, divided into columns and contents, and the style is simple and practical. The assessment page will not only show the student's name, class, and the name of the item, but also the time is taken, total time, number of questions, and the completion progress of the part, so that students can keep track of their progress and answer status. The Chinese Vocabulary Assessment System mainly consists of discrete test questions in the "minimum context", which refers to "the shortest context in which the test target can become the only target". The system currently has three types of questions, that is, unequal matching, set of multiple-choice fill-in-the-blank, and multiple-choice. This is designed to be a discrete test that assesses a clear knowledge or ability point and provides clear feedback and diagnostic information to teachers and students. Minimum context questions are designed to reduce the amount of interference from other knowledge that can affect the validity of the question. Matching questions are suitable for testing linguistic items that have a fixed connection, such as matching the form, sound, and meaning of words. Matching questions can obtain more information from students in less space, are more economical and practical, and are easier to computerize.

2.3 Evaluation Feedback Format and Content Design

Feedback is an important way for teachers and students to obtain information, is the basis for the discovery of student status as well as cognitive development and the development of teaching strategies for teachers, and has considerable importance in the overall assessment. The feedback form is the way the system presents the feedback content, and its presentation should take into account the needs of users and the situation of the content presented, in pursuit of practicality, convenience, and humanity. The system is designed for college students and adult Chinese learners. In the form of feedback, we pursue simplicity and practicality and avoid excessive fancy design. To avoid the difficulties caused by the low Chinese level of some users, some feedback will take the form of both target language and intermediate language (English). As shown above, feedback is used in a variety of presentation methods, mainly text, charts, images, and sound, four kinds of media, mainly in the form of text, charts, images, and sound, while supplemented by animation and video forms. Teachers can not only see the feedback of students in their classes but also see how their classes performed in the exam through the class performance analysis in Performance Management. Users can click on "Highest Score" and "Lowest Score" to enter the corresponding student feedback page so that teachers can further understand the mastery of students. "The larger the standard deviation, the greater the difference between the student's score and the average score; the smaller the standard deviation, the closer the student's score is to the average. Generally speaking, the standard deviation of the Chinese Language Achievement Test should not be too large. "Normal distribution" is a kind of probability distribution, also called "normal distribution", with more in the middle and less at both ends, and the more people take the test, the more obvious this phenomenon is. According to the students' test results, the system will automatically calculate the difficulty of each question and the degree of differentiation so that teachers can modify the less scientific questions to improve the reliability and validity of the questions.

3 IMPLEMENTATION AND OPTIMIZATION OF CHINESE VOCABULARY ASSESSMENT SYSTEM IN INTERNATIONAL CHINESE LANGUAGE TEACHING

3.1 System Building Model

To adapt to the development trend of computer-aided assessment and to enable learners to use the vocabulary assessment system conveniently for Chinese language learning, the system adopts a browser/server-based structure and can be used as long as learners have access to the Internet.

The B/S structure is divided into three parts, that is, the browser, the server, and the database, also known as the presentation layer, the functional layer, and the data layer. The browser is a user-oriented interface and a window for information interaction, and the browser

layer consists of Web pages. The server layer is the core part of the system functionality, data processing, statistical analysis functions are concentrated in this part. The database mainly stores user information, topic information, data generated in the test, etc. The construction mode of the system is shown in Figure 3. For specific implementation, the system uses WINDOWS2008 as the Web server system, SQLSEVER as the database platform, and ASP.NET as the database access language.

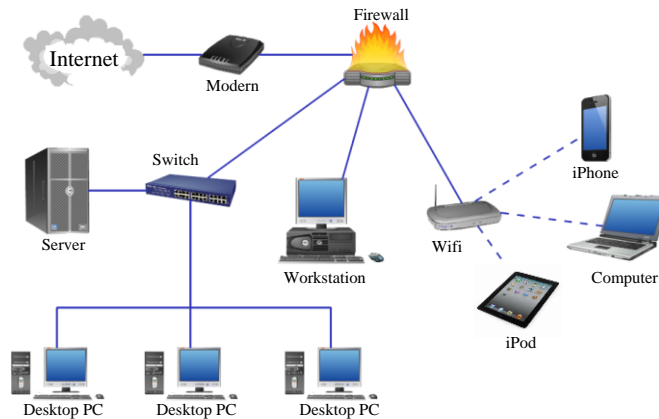


Figure 3: Network Structure of Chinese Vocabulary Assessment System.

3.2 System Function Implementation and Optimization

The test module is also the core part of the system and is divided into three test items according to a target word in the assessment scheme. The same test items for all the target words are placed together in the specific test to avoid interfering with the three tests for the same target word. Therefore, the items are divided into three tests, namely, the morphological word test, the phonological word test, and the lexical word test. The first test item is the "Morphological Use Test", where the system will automatically play the instructions of the questions so that the test takers can understand the meaning and operation of the questions on the one hand, and on the other hand, the voice will enhance the sense of communication, familiarize themselves with the voice of the announcer of their choice, and quickly adapt to the test atmosphere. Next, we move on to the "Word Form Word Usage Test". First, you click on the "Play" button, and a sentence with an explanation of an idiom is played. Then write the missing words on the handwriting board. Select the correct word on the right handwriting board and click on the "Next" button to move on to the next word in the test.

The design of the system is mainly based on the operation of the system and the design of the interface. 57% of the students found the system easy to operate and 36% of the students found it easy to operate, which is more than 90%, indicating that the students have a high recognition of the convenience of the vocabulary assessment system. Convenient operation is the advantage of computer-aided assessment, which can be completed by mouse clicks, and the test will automatically move to the next step after answering the questions. Nearly 80% of the users said that the system is easy to use and aesthetically pleasing, but 20% of the users thought that the system is easy to use but not aesthetically pleasing. Overall, the ease of use of the system's interface was recognized by the vast majority of the respondents. The interface of the system is the window of interaction between the computer and the user, and the aesthetics and ease of use of the interface directly affect the effectiveness of the interaction. Learners have a high opinion of the ease of use and practicality of the system interface, mainly because the system's functions are reasonably laid out and easy to use. As shown in Figure 4, the system's interface was not designed

by professional artists and was relatively simple and lacking in aesthetics, which was something that needed to be modified and improved.

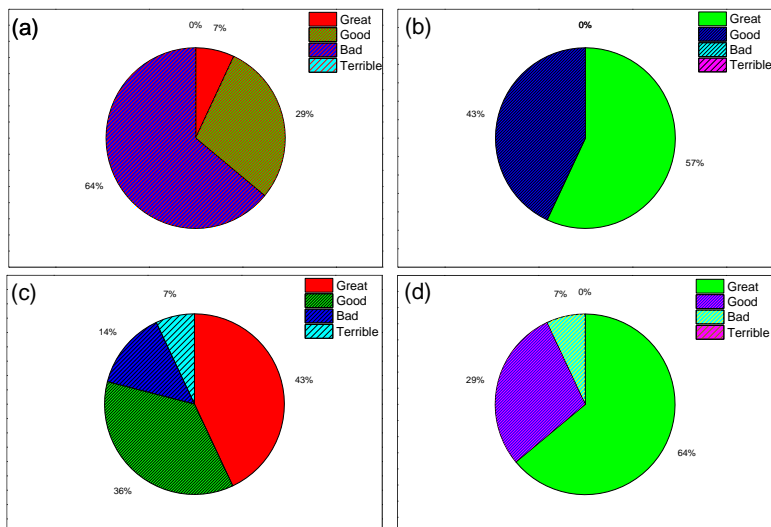


Figure 4: Evaluation of each teaching content after the optimization of the international Chinese teaching vocabulary evaluation system.

3.3 Analysis of the Results of the System-optimized Assessment of International Students

Comparing the changes of international students' preliminary Chinese language proficiency from 2017 to 2019, the overall Chinese listening and speaking ability of international students is developing upwards, and the two skills of "mastering Chinese vocabulary" and "awareness of preliminary sentences" are restricting international students' preliminary Chinese language proficiency. The scores of different levels questions were converted into statistics, and international students were divided into four levels according to their scores.

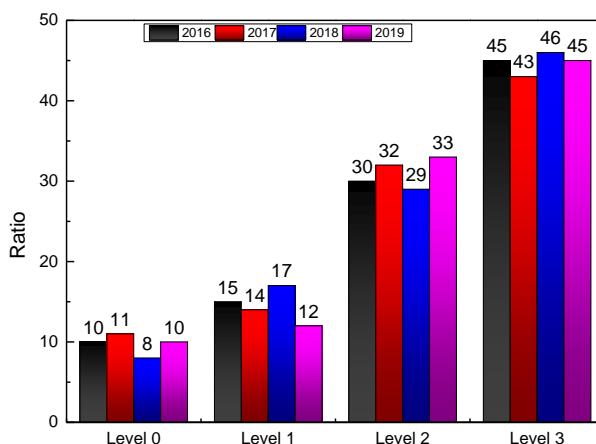


Figure 5: Distribution of Chinese Language Achievement Levels of International Students in the Chinese Vocabulary Test.

As shown in Figure 5, we can see the change of grade level in the three years of 2017, 2018, and 2019, with a higher grade level representing higher Chinese proficiency. Compared with 2017 and 2018, the proportion of 0 and 1 grades in the grade distribution in 2019 has decreased, but the proportion of 2 and 3 grades has increased. From this, we can see that the Chinese proficiency level of international students from 2017 to 2019 is relatively stable and shows an overall upward trend. The monitoring results show that international students' "Chinese vocabulary mastery" is the weakest, and there is no big difference in the scores of other abilities. 2018 The results of the monitoring showed that international students were weakest in the acquisition of Chinese vocabulary and initial statement awareness. The mean score for Chinese vocabulary mastery was high, but the standard deviation was the highest, indicating that international students' scores in this subcategory were discrete and disparate, and their scores were low, ranking second from the bottom. Preliminary statement awareness had the lowest mean score, the lowest percentage of scores, and a low standard deviation. The 2019 monitoring results show that the lowest scores continue to be in "Chinese Vocabulary" and "Preliminary Sentence Awareness". The mean score and standard deviation of the Chinese vocabulary mastery score are the highest, and the dispersion is obvious, with a score of 54.7%, ranking second to last. The mean score, scoring rate, and standard deviation of preliminary sentence awareness are all the lowest, which means that international students' scores in this subcategory are less discrete, and their performance is generally poor and their scores are low.

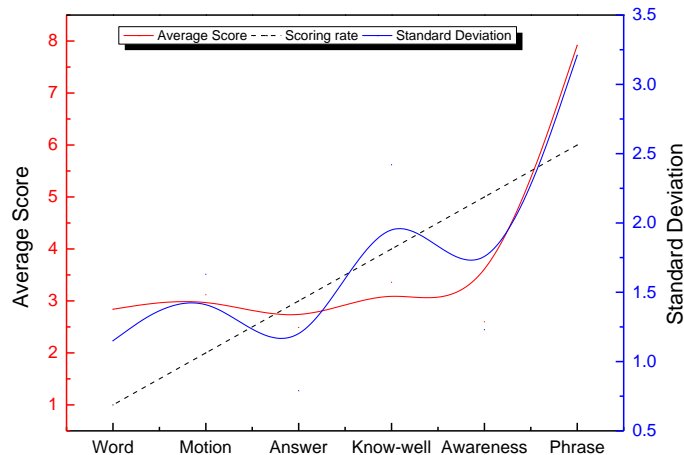


Figure 6: Analysis of Chinese vocabulary acquisition of international students.

By comparing the scores and trends of the Chinese language abilities of international students in previous years, we can not only grasp the factors that affect the preliminary Chinese language ability of international students but also identify the obstacles and bottlenecks in Chinese language teaching for the improvement of international students' Chinese language ability. Comparing the trends of international students' preliminary Chinese language ability from 2013 to 2019, we can see that the overall Chinese listening and speaking ability of international students is improving, but the two skills of "mastering Chinese vocabulary" and "awareness of preliminary phrases" are still unsatisfactory and have become bottlenecks in Figure 6. The main obstacle in the development of international students' preliminary Chinese language skills. Among the four basic skills of listening, speaking, reading, and writing, listening and reading belong to the stage of language input while speaking and writing belong to the stage of language output. Second language learners need to go through a series of processes from input to output to acquire language skills, and language output is more difficult than language input. From the past teaching practice, the language output of students from European countries is a difficult point of teaching

and learning, which is also reflected in the bilingual quality monitoring of international preschool students.

Vocabulary is the building material of language and without a certain amount of vocabulary and its knowledge, no language creation and understanding can occur. Therefore, the development of vocabulary knowledge is the most basic prerequisite for language acquisition". At the same time, vocabulary is also a reflection of natural and social cognition, including the cultural connotations of the target language. The acquisition of vocabulary is significant for international students learning a second language, so international students' vocabulary mastery should be tested first. The scores of the recognition reminders reflect international students' mastery of Chinese vocabulary. Monitoring tested 40, 40, and 34 Chinese vocabulary words in 2017, 2018, and 2019, respectively, for a total of 114 Chinese vocabulary words. These 114 words are briefly categorized according to the function and nature of the vocabulary. The specific categories of vocabulary examined in the 3 years and the scoring rate of each category are shown in Figure 7.

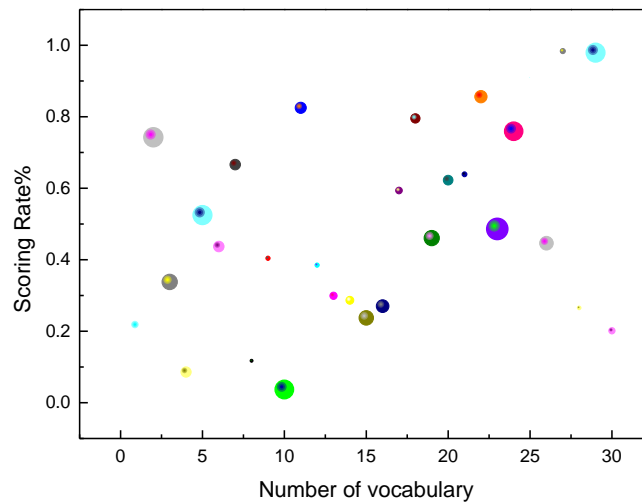


Figure 7: Statistical Analysis of Chinese Vocabulary Scores of International Students.

In terms of statistics such as mean and standard deviation, among the 15 categories of Chinese vocabulary, the highest mean values are fruit and body part nouns, and the standard deviation is also small, indicating that international students score higher on these two types of vocabulary with less dispersion and better mastery. The standard deviation of the nouns of furniture and home furnishings and transportation was larger, which indicated that international students scored more discrete and differential on these two types of vocabulary. The second is animal, clothing, vegetable, plant, food, natural environment nouns, and verbs, with the lowest mean value of 0.23 and the second-lowest standard deviation for household goods nouns, which shows that international students have a poor grasp of household goods nouns. In terms of the proportion of the test, the highest proportion of nouns in the category of animals was about one-fifth of the total, followed by nouns in the categories of household goods, clothing, fruits, and furniture, each accounting for about one-tenth of the total. The remaining categories of nouns were examined less frequently in proportion to their frequency.

It can be seen that in 2017, the scoring rates were concentrated around the low values, i.e., international students generally had poor ability in this type of test. In 2019, the scoring rates increased significantly and were almost balanced in the low part of the high school, but the proportion of low scores was still high. This indicates that among the six competencies tested, poor

ability in statements is the main obstacle for international students to develop preliminary Chinese listening and speaking skills.

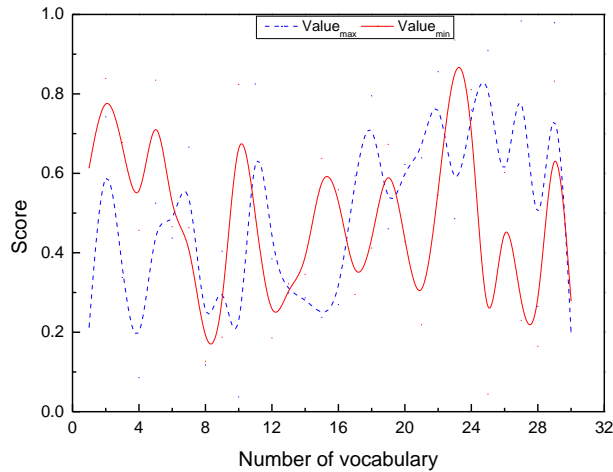


Figure 8: Descriptive Statistical Analysis of Chinese Language Students' Awareness of Statements.

Figure 8 shows a graph of the number of each type of vocabulary in the teaching materials over the 3 years of monitoring. The graph shows that the highest proportion of animal terms in the teaching materials, and correspondingly, the highest proportion in the monitoring, scored in the middle of the overall range. It is not surprising that international students have a poor grasp of such vocabulary since the number of household-item vocabulary in the textbook is small and the proportion of such vocabulary in the monitoring is large. Second language teaching emphasizes the application of what is learned to arouse students' interest and build their confidence in learning. Chinese teaching materials for preschool international students emphasize storytelling and fun, and the presence of animals and plants is desirable. However, it is also one of the principles that the teaching materials should be adapted to the life of international preschool students in European countries. Fun and life should not be contradictory, but complementary. The living of teaching materials can not only stimulate the interest and enthusiasm of international students in learning, but also make them practical in life, solve language problems, expand and improve language practice, and form another way to learn the language. Therefore, Chinese textbooks for preschool international students should increase the occurrence and recurrence of the vocabulary of daily necessities, so that the Chinese learning of international students can be closely related to their daily lives, and the combination of learning and application can increase the interest and efficiency of Chinese learning.

4 CONCLUSION

This paper identifies the needs of the system users, proposes the system design objectives, system framework, modules, and the functions of each module, and forms a preliminary overall scheme of the computer-assisted Chinese vocabulary assessment system. Based on Nation's classification of vocabulary knowledge and the characteristics of Chinese vocabulary, the current question types and methods of Chinese vocabulary assessment are analyzed, and the forms and question types of Chinese vocabulary assessment are designed. Feedback is the focus of the system, and targeted feedback items and corresponding forms for teachers and students were designed according to their needs, and a basic usable framework was constructed. According to the design of the system,

computer technology was used to implement the registration login, management, testing, evaluation, and feedback functions of the system to achieve the set objectives. This paper investigates the application of the system and collects evaluations from students and teachers on the use of the system. The Chinese vocabulary assessment was used as an example to build a testing platform and to lay the foundation for further research. However, the construction and improvement of a computer-assisted Chinese vocabulary assessment system is a long-term process that requires the cooperation of Chinese language teachers, computer technicians, and users. At present, the study has the following shortcomings: the content and format of Chinese vocabulary assessment have not been verified by scientific experiments, and are highly subjective. Due to technical limitations, the question format is still not comprehensive enough, and the pronunciation, writing, and subjective questions cannot be scored automatically.

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