# Design and Implementation of Credit Banking System Based on Qualification Framework

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**Abstract.** In order to solve the problem that the learning outcomes of students and the courses of talent training program can not be effectively connected, the credit bank system is developed. The system adopts a typical three-layer system architecture layered design, using Java object-oriented programming language and Oracle 11G database programming platform, the system is designed as a subsystem, integrated into the school teaching management platform. Through the trial operation of the system, students can process, standardize and standardize all types of learning outcomes through the set learning outcomes recognition and conversion rules, and the final conversion outcomes can be seamlessly received from students' academic report card. The practice shows that the system can realize the information and paperless operation of the recognition and conversion of students' learning outcomes, and the system is available and easy to use. It has certain reference value to play the role of "flyover" of credit banks and improve the quality of talent training.

**Keywords:** qualification framework, credit bank, learning outcomes, recognition and conversion

## 1 Introduction

The qualification framework was proposed by the United Kingdom as early as the 1980s[1], and China also began to introduce this concept in 2016. In 2019, the Implementation Plan of the National Vocational Education Reform proposed to "promote the construction of the qualification framework and explore the realization of the interconnection between academic certificates and vocational skill level certificates"[2][4]. With the development of lifelong education, there is a growing need for a platform to store all kinds of learning outcomes. Credit bank was developed under such background[3]. At present, China's credit banks have entered the fast lane of development, not only the national credit bank platform: The national credit bank for vocational education and the corresponding credit bank platforms have been developed in various provinces, such as the lifelong education credit Bank in Guangdong[5]. Currently, there is a difficulty in these platforms, that is, they cannot be converted into the courses of the school's talent training program. For students, in addition to the course


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learning in the learning plan, there are various learning outcomes, and there is no recognized standard and platform. These achievements cannot be recognized and converted, which is a loss and injustice to students. Therefore, from the perspectives of national vocational education development, credit bank development and respect for students' personalized development, there is an urgent need for a platform that can store students' learning outcomes and convert them into course scores to serve students and promote their all-round development.

## 2 Overall design idea

The development goal of credit banking system is to integrate student data, course data and learning outcomes data through modern information technology means, and open up data islands. In addition, by changing the working mode of relevant teaching management, the recognition and conversion of learning outcomes can be converted from offline to online, and the collection and review of tedious offline supporting materials for learning outcomes, the recognition of student credits, the storage of student credits, and the conversion of courses can all be informationized. The recognition and conversion of students' learning outcomes can achieve standardization, informatization, standardization and convenience[6][7].

The form of credit banking system mainly includes the process of learning outcome recognition, learning outcomes storage, learning outcomes accumulation, learning outcomes conversion. The logical basis of this system is the qualification framework, which is the standard of credit recognition and conversion. The recognition, storage, accumulation and conversion of learning outcomes must be based on standards, the construction of standards is the core of the system's business logic, and the construction of standards in the system is also the rules for the recognition and conversion of learning outcomes[8]. The basic logic is shown in Fig. 1.

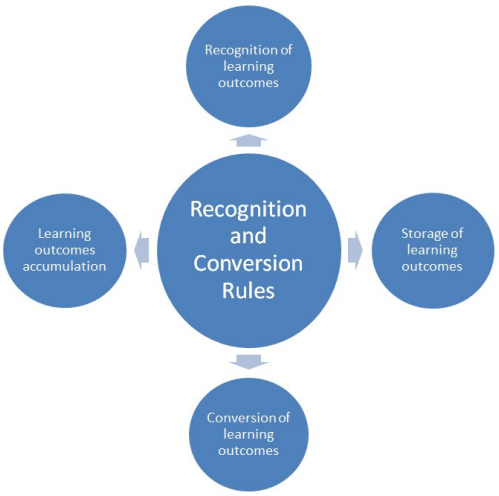


**Fig. 1.** Learning recognition and conversion rules is the logical foundation

The framework design of credit banking system adopts three layers: presentation layer (UI), business logic layer (BLL) and data access layer (DAL), as shown in Fig. 2. The purpose of the three-tier architecture is to "high cohesion, low coupling". The division of labor of developers is more clear, and the energy is more focused on the analysis, design and development of the core business logic of the application system, which speeds up the progress of system development, improves the development efficiency, and is conducive to the update and maintenance of the system[9]. The presentation layer is the interface of user interaction, the system will adopt B/S structure, with high compatibility, and can be compatible with the mainstream browsers in the market. The salesman logic layer is the business flow of the system, the basic business of the system is: student application, process review, outcomes storage, outcomes conversion, report card, report printing and so on. Data access layer is the data processing unit of the system, including database server, database access and reading, data increase, delete, modify, query and other operations.

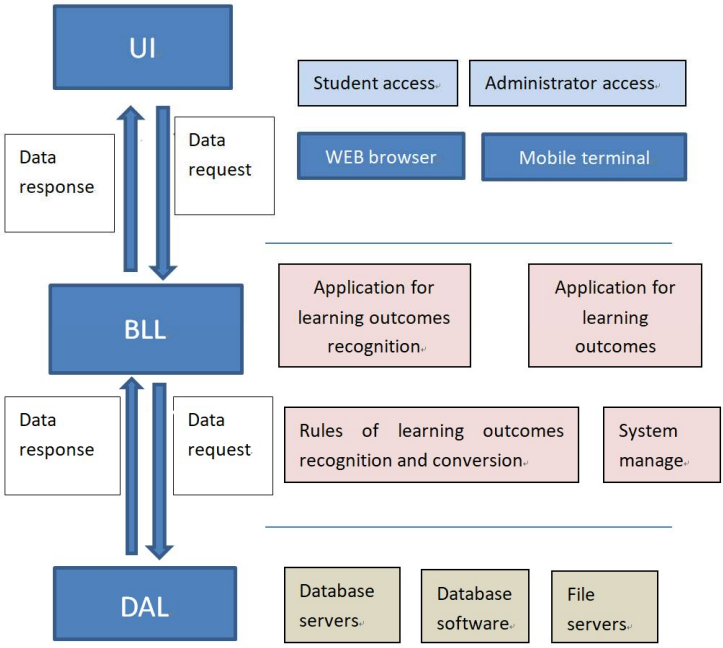


**Fig. 2.** Basic architecture of credit banking system

The credit bank system is a system serving students, and students need to connect with the courses of the talent training program. The learning outcomes recognition and conversion system adopts a modular design. After the development of the whole system, it will be integrated into the educational administration management platform of the school as a subsystem to realize the integration and docking with the educational administration management platform of the school. The advantage of this design idea is that it can effectively use the basic data of other subsystems of the educational ad-

ministration management platform, such as student data, course data, etc., and as a subsystem of the educational administration management platform, it can blur the abruptiness of the credit bank system, so that students can be completely integrated into the educational administration management platform, and at the same time, it can save the development time and cost.

At the same time, the credit banking system is also scalable, and considering the subsequent sustainable development, the data of the school can also be connected with the superior credit banking system, so as to realize the achievement recognition of students' lifelong education.

## 3 Needs analysis

Credit banking system is a platform to provide students with learning outcomes recognition and conversion services, with the purpose of serving students, aiming to help students better manage and use their own outcomes[10]. User needs have two levels: student and manager:

### 3.1 The needs of students

The demand of students in credit bank is that students can realize the conversion of learning outcomes and reflect the value of various achievements.

1. Learning outcomes recognition: Recognition of learning outcomes is the process of recognition the learning outcomes and other outcomes embodied in the vocational education and training evaluation organization and the vocational skill level certificates developed by them with credit bank credits in accordance with unified rules. The recognition of learning outcomes is the basis for the accumulation and conversion of learning outcomes.

2. Learning outcome storage: Learning outcomes storage is the process of labeling and classifying the learning outcomes of recognized institutions and individuals, and depositing them into institutional and individual learning accounts respectively.

3. Learning outcome conversion: Learning outcome conversion refers to the process in which learners apply for learning outcome conversion in accordance with the conversion rules issued by credit banks, and training evaluation organizations and relevant colleges and universities apply for academic and professional credit replacement or vocational skill level certificate module exemption for applicants according to the conversion measures and conversion rules.

### 3.2 The needs of managers

1. Credit recognition and conversion standards: the establishment of standards, with this standard to establish a platform to achieve. The final presentation is that the student's report card can be identified by the outcomes of the corresponding course. The criteria include the type and grade of the outcomes, the nature of the course, the credits and the grade level of the outcomes.

2. Business audit process: All business processes can be systematically reviewed. The audit process can have the function of batch review and return.

3. Data search and statistics: all data can be queried, counted and exported.

4. System Settings: Set permissions, roles, and customize the review process

### 3.3 Business process

The basic business process is: student recognition application - review - credit storage - student conversion application - review – report card, as shown in Fig. 3.

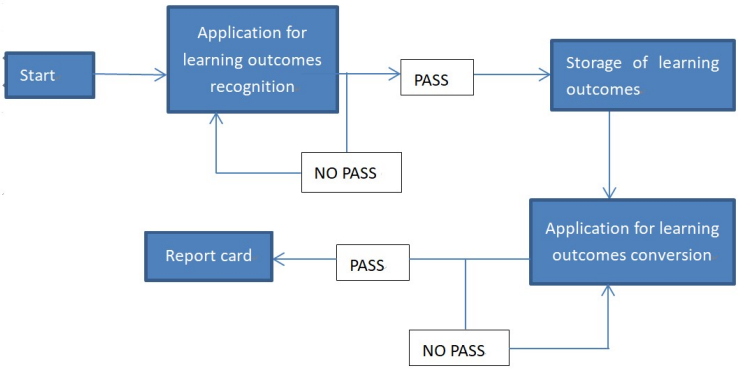


**Fig. 3.** Business process of the credit bank system

## 4 System design

### 4.1 Database design

The database of the credit bank system uses oracle 11G, and the programming tools use PL/SQL. As a subsystem, the system is designed to integrate with the educational management platform of the school, so the design of data tables can be reduced. The main design of the following data tables:

1. Learning outcomes recognition rules table: storage of learning outcomes recognition rules and conditions, the basic fields include learning outcomes type, learning outcomes level, learning outcomes name, learning outcomes credits, etc.

2. Credit storage table: Store the credit information of students' learning outcomes, including student information, which can be associated with the student information of the educational administration platform, credit recognition, credit cancellation information, etc.

3. Learning outcomes conversion rule table: including the nature of the corresponding course and the corresponding grade level that can be converted, and the course information can be associated with the courses of the student talent cultivation program of the educational administration platform.

E-R relationship diagram of database of credit bank system is shown in Fig. 4.

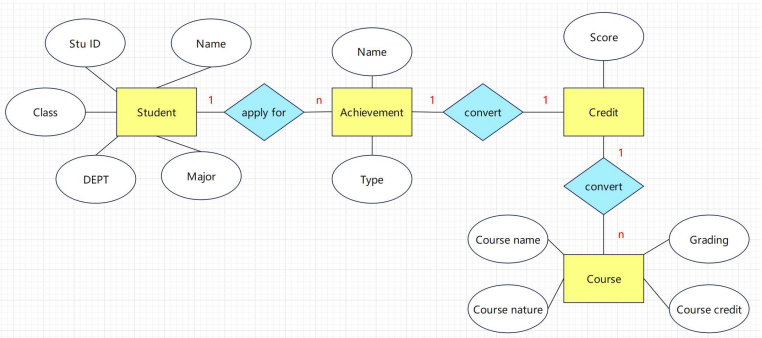


**Fig. 4.** E-R relationship diagram of database of credit bank system

## 4.2 Functional design

The main functions of credit bank include: system management, rule settings, application for learning outcomes recognition, review of learning outcomes recognition, application for learning outcomes conversion, review of learning outcome conversion, statistics and query management, and performance display, as shown in Fig. 5.

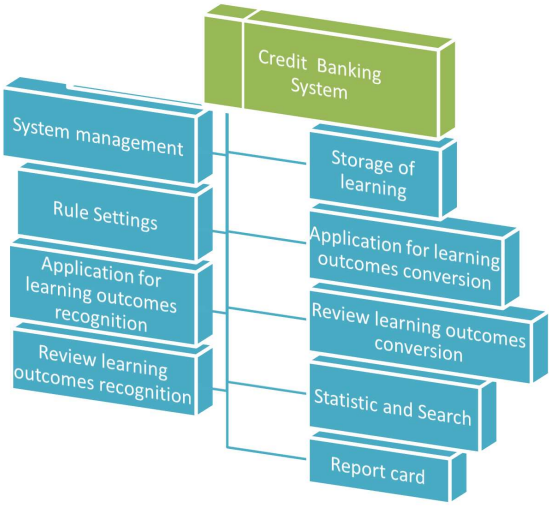


**Fig. 5.** Main functions of credit banking system

1. System management: System management is the control unit of credit bank system, which can set role assignment, authorize credit bank management functions to assigned roles, set time control of credit bank application, and customize the review process of each link.

2. Rule settings: Rule settings is the logical core of the banking system, and business logic judgment is implemented according to this rule. Rules for the recognition of learning outcomes and rules for the conversion of learning outcomes can be set.

3. Application for learning outcomes recognition: Students can apply online through the system, and the application for learning outcomes database must be based on the learning outcomes recognition rules. Students can only select the type and name of learning outcomes within the rules to reduce data inconsistency caused by manual input by students.

4. Review of learning outcomes recognition: The review interface is provided for managers. The review process must be customizable. At the same time, you can query and export data on the audit interface.

5. Learning outcomes credit storage: Store credits recognized by students after passing, students can inquire.

6. Application for conversion of learning outcomes: Students apply for conversion of learning outcomes through the system. Students apply for conversion of learning outcomes according to the rules of conversion of learning outcomes, and which courses can be converted according to the rules.

7. Review of learning outcomes conversion: provides an interface for managers to review. The basic function of audit is similar to that of learning outcomes recognition audit. The audit process can be customized, and operations such as batch audit and return can be conducted.

8. Statistics and query management: This function requires that information such as student application records, audit records, and summary of student credits can be queried, and all interfaces can export data.

9. Report card: This function is the final result of the learning outcomes system that students are most concerned about, that is, students can convert various outcomes into courses, course information including credits, grades, etc. And the score record can show that the score has credit bank conversion mark.

10. Calculation rules for sharing outcomes among multiple people: This is a bright spot of the system design. According to the design ranking rules, students with different rankings will receive different credits for their outcomes. The specific ranking distribution ratio is shown in Fig. 6:

| Number of persons | Ranking Ratio | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | First | Second | Third | Fourth | Fifty | Sixth | Seventh | Eighth | Ninth | Tenth |
| 1 | 100% | | | | | | | | | |
| 2 | 70% | 30% | | | | | | | | |
| 3 | 50% | 30% | 20% | | | | | | | |
| 4 | 45% | 25% | 18% | 12% | | | | | | |
| 5 | 44% | 24% | 17% | 8% | 7% | | | | | |
| 6 | 43% | 23% | 16% | 7% | 6% | 5% | | | | |
| 7 | 42% | 22% | 15% | 6% | 6% | 5% | 4% | | | |
| 8 | 41% | 21% | 14% | 6% | 6% | 5% | 4% | 3% | | |
| 9 | 40% | 20% | 13% | 6% | 6% | 5% | 4% | 3% | 3% | |
| 10 | 40% | 19% | 12% | 6% | 6% | 5% | 4% | 3% | 3% | 2% |

**Fig. 6.** Multi-person outcomes ranking proportional distribution table

## 5 System operation

After the development and testing of technology, the credit banking system was launched and put into trial operation in a higher vocational college in the first half of

2023. During the trial operation of the system, a total of 146 students applied for learning outcomes recognition, and 124 students passed the audit. 104 students applied for learning outcomes conversion applications, and 92 students were approved and received corresponding course credits. The test run is good, the system runs stably, the interface operation is simple and easy to understand, the rules are set up in line with the requirements of the school, the students from the identification and conversion of learning outcomes to the final student report card shows, the operation process is smooth. The development of the system has greatly reduced the time for students to apply for affairs and improved work efficiency. Compared with before, the working time of credit banking system has been reduced from one month to one day. Students do not need to rush about submit various paper materials. It is well received by teachers and students.

## 6 Conclusion

Based on the qualification framework, this paper establishes a credit bank system, which is built by combining Java and Oracle technology. Combined with the actual situation of universities, this system is integrated into the educational administration management platform of the school as a subsystem. The system can identify and convert students' various types of learning outcomes on the information platform by setting the rules for identification and conversion of learning outcomes, and seamlessly receive the final conversion results to students' academic report card, objectively record the identification and conversion of students' learning outcomes, and realize the recognition and conversion of standardized, informationized and standardized learning outcomes. With the support of the system platform, it can greatly promote the personalized development of students and the comprehensive development of students' morality, intelligence, physical fitness, the United States and labor. Therefore, the development of this system can meet the diversified learning needs of students, expand the learning channels of students, expand the supply of high-quality learning resources, play the role of credit bank as a "flyover" for talent development, promote the reform of "1+X" documentary evidence integration and improve the quality of talent training, and have certain reference value. The establishment of this system can also provide practical value with operability for other vocational colleges.

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