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# Research and design of work–study system under the background of vocational education

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**Abstract:** With the rapid development of vocational education, work–study programs have attracted widespread attention as an important way to cultivate students’ practical ability, professional literacy and economic independence. However, there are many problems in the implementation of work–study programs, such as the lack of educational attributes of work–study positions, insufficient protection of students’ rights and interests, and imperfect management models. Therefore, based on the characteristics of vocational education, this paper studies and designs a scientific and efficient work–study system around job supply, student practice and school management. By deeply mining work–study data, it provides students with personalized online courses and job recommendation, and issues competency certificates. These innovative measures promote the deep integration of vocational education and work–study programs, provide students with a more fair and efficient practice platform, and provide vocational colleges with a new work–study talent training model.

**Keywords:** vocational education; work–study program; system design; practical ability; personalized recommendation

## 1. Introduction

In China, vocational education is as important as general education [1]. It is committed to cultivating high–quality technical and skilled personnel. Its teaching system is centered on practical teaching. In principle, practical courses account for more than half of the total class hours, including volunteer service, course practice and job internship, in order to enhance students’ practical operation ability and professional quality.

As an educational method that combines learning and labor, work–study has unique advantages in vocational education. It can not only help students apply theoretical knowledge to practice and improve their professional skills, but also cultivate their sense of social responsibility, teamwork spirit and independent problem–solving ability [2]. However, there are many problems in the implementation of work–study programs, such as the lack of educational attributes of work–study positions, insufficient protection of students’ rights and interests, and imperfect management models, which seriously affect the implementation effect of work–study programs. Therefore, researching and designing a work–study system that adapts to the



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characteristics of vocational education is of great significance to promoting the standardization, informatization and efficiency of work–study programs.

## 2. Problems in work–study programs for vocational education

Through preliminary research and analysis, we found that work–study programs in the current vocational education context mainly face the following three key problems.

First, work–study positions lack educational attributes. At present, many vocational colleges simply equate work–study with part–time jobs. However, research shows that there are essential differences between the two. Part–time jobs are personal behaviors of students, and their positions usually lack educational attributes, while work–study is an organizational behavior of the school. School teachers and enterprise mentors jointly formulate job standards, incorporate job practice content into curriculum practice and professional talent training system, and convert it into practical credits to make it have educational attributes [3]. Therefore, vocational colleges should incorporate work–study into the talent training system, and work–study should run through the entire talent training process to better promote the development of students' professional abilities. Taking the three–year higher vocational college of Xiamen Nanyang Vocational College as an example, it has set 20 credits for work–study, and 1 credit is obtained for every 16 hours of work–study. Work–study credits can be deducted from practical teaching credits. The work–study of first–year students is mainly social practice (no limit on positions), the second year is mainly course practice (related to majors), and the third year is mainly graduation design (undertaking real corporate projects).

Second, the rights and interests of students in work–study programs are not adequately protected [4]. In the process of work–study programs, the protection of students' rights and interests is particularly prominent. First, the choice of positions is limited. Currently, there are relatively few work–study positions available for students to choose from. They mainly rely on recommendations from teachers or seniors, and lack a systematic job matching mechanism. As a result, the positions are less relevant to students' majors and interests, making it difficult to meet students' personalized needs and affecting their career development. Second, the salary and benefits are not transparent. Some work–study positions have low salary standards, delayed or untimely salary payments, and some companies do not even provide reasonable remuneration. In addition, the rights and interests protection mechanism is weak. If students encounter unfair treatment, poor working environment or salary disputes at work, they often lack effective channels for appeal, which increases the risk of participating in work–study programs.

Third, the work–study process management model is imperfect. As an important model for cultivating talents in vocational education, work–study should establish a sound management system [5] to ensure smooth cooperation among enterprises, students and schools. However, the current work–study management model still has many shortcomings. First, there is a lack of evaluation system. Schools have not yet established a sound assessment mechanism. There is a lack of channels for students to provide feedback on enterprise positions and a lack of scientific evaluation of students' work performance by enterprises. At the same time, the school's recognition of work–study and credit deduction standards are not clear enough, which makes it difficult for work–study to fully play its role in the vocational education system. Secondly, there is a lack of labor agreements. Since schools have not established a formal labor agreement system, there is no clear legal constraint on enterprise job responsibilities, enterprise mentors' guidance responsibilities and students' work behaviors. This may not only lead to enterprises arbitrarily changing work content and

lowering salary standards, but also make it impossible for students to effectively protect their rights when labor disputes occur, affecting the long-term stable operation of work-study.

### 3. Current status of research and design of work-study system

In recent years, several studies have proposed different solutions. In 2018, Xu Xin proposed using computer technology to improve the efficiency and effectiveness of work-study management in colleges and universities, and emphasized the importance of computer technology in supporting needy students [6]. In the same year, Zhang Cheng also pointed out that there were management problems in work-study programs in colleges and universities, and that developing a management system could significantly improve efficiency and practical educational results [7]. In his 2018 research, Bian Xiuyun designed and implemented a computer management system for college students to work and support their studies. The system adopted a B/S structure and was developed using Apache Tomcat and SQL Server. The specific implementation details of the system were demonstrated [8]. In a 2021 study, Bai Lan analyzed the role of information technology in improving the efficiency of work-study management in colleges and universities, pointing out that information technology can not only reduce costs but also promote the development of work-study programs [9]. In 2022, Liu Lixia proposed a work-study system design based on the “four-in-one” concept, using information technology to achieve functions such as job matching, evaluation, and credit recognition, further enriching the application scenarios of the work-study system [10]. In his 2024 research, Yuan Xiao explored the problems and solutions of work-study programs in colleges and universities in the new era, and emphasized the important role of work-study programs in supporting students with financial difficulties and cultivating compound talents [11]. In 2019, Chu Moong L. developed and preliminarily validated a scale for assessing work-study consistency among college students. The scale covers four areas and provides instrumental support for subsequent research [12].

In summary, these studies have jointly promoted the development of the work-study management system. Through different technical means and management methods, the system's efficiency and practicality have been improved, providing strong support for colleges and universities to subsidize needy students and promote talent training. However, none of them can solve the three main problems of work-study in vocational education. Therefore, we propose that work-study is a talent training model, and work-study is integrated with practical education in talent training programs, that is, work-study is students' practical teaching in a real working environment, and work-study is set up; from a technical point of view, artificial intelligence technology is applied, especially the application of personalized recommendation algorithms based on multi-learning goal optimization, to achieve personalized recommendation of online learning concepts, knowledge and practical positions based on students' majors, interests, future goals, learning tests and other factors; from the perspective of result application, based on students' work-study big data, analyze students' areas of expertise, abilities and deficiencies, remind students to play to their strengths and avoid their weaknesses when they are employed, and issue competency certificates.

### 4. Design requirements analysis of work-study system

Based on the concept that work-study is a talent training model, through preliminary research and review of relevant documents, the design requirements of the work-study system are analyzed as follows.

(1) Job and unit information management. First, strictly review and manage the qualifications, reputation and employment needs of units that provide work–study positions to ensure the legitimacy and reliability of employers. Secondly, the system has the functions of real–time release, efficient query, accurate matching and dynamic update of job information to fully reflect the status and latest needs of work–study positions.

(2) Student and school information management. First, the qualifications of schools joining the system should be strictly reviewed and managed to ensure the authenticity and accuracy of the information. Secondly, the system should comprehensively record and manage students’ basic information, learning status, work–study experience and credits, *etc.*, to provide strong support for the accurate matching and personalized recommendation of work–study positions.

(3) Job push and online registration. First, the system needs to intelligently recommend suitable work–study positions based on students’ majors and interest preferences. Secondly, students can conveniently register for work–study positions online or register with their teachers, and quickly sign the agreement to improve work efficiency.

(4) Work–study assessment and evaluation. First, the system should record and assess students’ work–study attendance and work performance in real time, providing a basis for remuneration and reward and punishment decisions. Secondly, it should provide a two–way evaluation mechanism between students, employers and schools, including students’ evaluation of the unit, employers’ evaluation of students and schools’ evaluation of students, and simultaneously recognize credits.

(5) Points rules and remuneration. First, the system should encourage teachers to actively introduce enterprises and develop work–study positions, and convert the teachers’ introduction of enterprises and positions and the students’ work–study hours into points, which can be used to exchange for prizes. Secondly, the system should support online calculation and payment of remuneration to ensure the accuracy and timeliness of remuneration.

(6) Information communication and rights protection mechanism. First, the system should provide real–time and convenient communication channels to promote information exchange between students, schools and employers. Secondly, a sound rights protection mechanism and process should be established to ensure that the rights and interests of all parties are effectively protected.

(7) Data analysis and competency certificates. First, we conduct in–depth analysis of students’ work–study data and the evaluation data of corporate mentors and school teachers to provide students with accurate online course recommendations and job push notifications. Secondly, based on the data analysis results, we generate authoritative competency certificates to provide strong support for students’ career development.

## 5. Design of work–study system

According to demand analysis, the work–study system consists of a web terminal and an app terminal, serving corporate personnel and tutors, school teachers and students. User roles are divided into school supervisors, students, teachers, corporate personnel, teachers, and system administrators.

(1) Supervisor: As the Collage’s system administrator, register a system account, import student and teacher lists, set user permissions, review companies and positions, view data, handle abnormal phenomena, calculate credits, analyze data, prepare statistical reports, *etc.*, and provide statistical analysis reports for school leaders.

(2) Students: as end users, complete personal resumes, match work–study positions [3] (including social practice, course practice, on–the–job internships, employment, *etc.*), work attendance, work experience, company evaluation, performance ranking, growth trajectory, salary slips, credit inquiries, undertaking outsourcing projects (including graduation projects, entrepreneurial projects, *etc.*), and ability certificates.

(3) Teachers: As instructors, on the one hand, they work with enterprises to develop work–study courses, and there are enough work–study courses for students to choose from; on the other hand, they guide students to apply knowledge in work–study jobs, to achieve the unity of knowledge and action, to learn by doing, and to do by learning.

(4) Enterprise personnel: As the system administrator of the enterprise, register to join the system enterprise pool or the school invites the enterprise to join the school’s cooperative enterprise pool, publish work–study job requirements (social practice, course practice, outsourcing projects, on–the–job internships, employment), evaluate students participating in work–study and issue wages, subsidies and bonuses.

(5) Corporate mentor: Dual role, both a supervisor and an instructor. As a supervisor, he/she issues work tasks and requirements; as an instructor, he/she guides students to complete their work tasks excellently and conducts process evaluation and final evaluation on students.

(6) System administrator: As the highest administrator of the system, he/she reviews the information of schools, students, enterprises and positions on the one hand; on the other hand, he/she serves the online customer service and handles various matters according to the set rules.

## 6. Functional modules of the work–study system

The system is divided into four modules according to user roles and work processes: school, student, enterprise, and system service. It serves school teachers and students, enterprise personnel and mentors, and implements process evaluation and supervision.

### 6.1. Student module (*learning by doing, doing by learning*)

Only students in the partner schools are allowed to register in the work–study system. The student information is uniformly imported by the administrator of the partner school, including: student number, name, grade, class, ID number, major, gender, contact number, and students complete their personal information after logging in with a mobile phone verification code, including personal tags, personal photos, height, weight, self–introduction, awards and honors, *etc.* The student module includes five major sections and 23 small modules, including “position, work, study, news, and mine”, as shown in Figure 1.

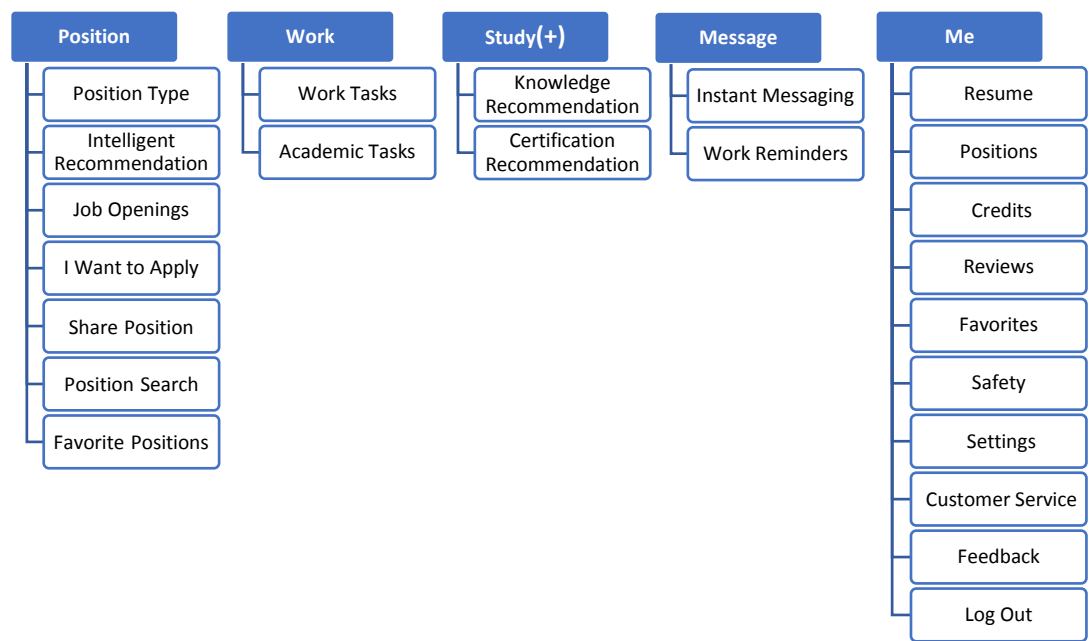


Figure 1. Student module.

6.2. Enterprise module (posting positions, finding talents)

The entry of new enterprises is the process of enterprise verification. You need to fill in the enterprise name, address, telephone number, business license, business registration number, effective date, industry, contact person, position, mobile phone number, ID number, and scanned copies of the front and back of the ID card. After being reviewed and approved by the cooperative school or system administrator, you can post positions and find talents. The enterprise module includes five major modules and 19 small modules: “Positions, Students, Release (+), Messages, and My”, as shown in Figure 2.

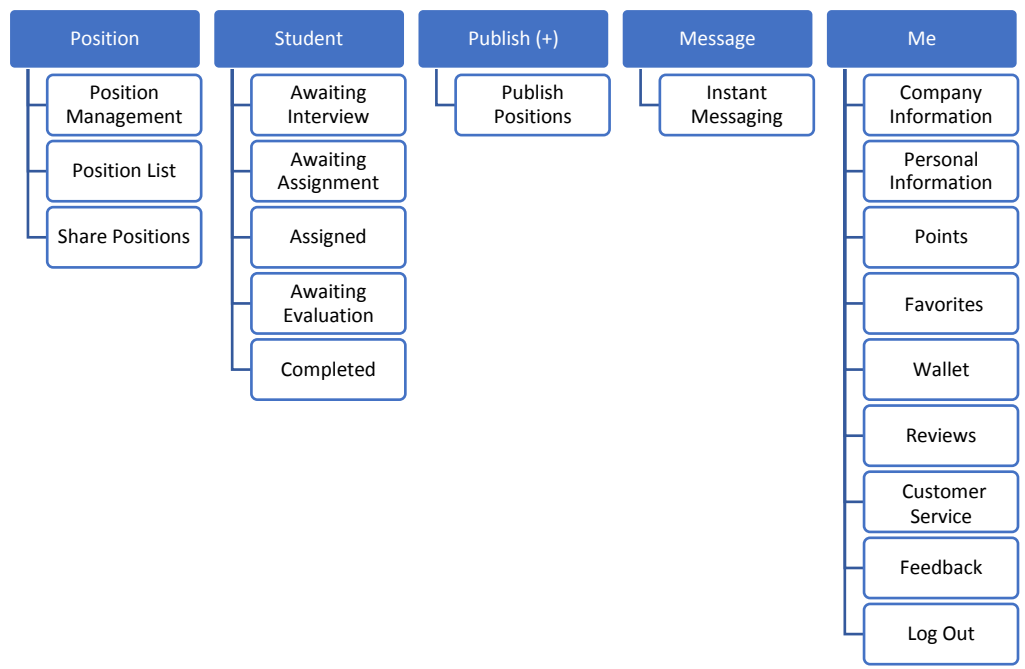


Figure 2. Enterprise module.

6.3. Collage module (close to industry, nurturing talents)

The new school entry is the school verification process, which requires filling in the school name, address, telephone number, school license, school license number, legal person, effective date, supervisory unit, contact person, position, mobile phone, ID number, and scanned copies of the front and back of the ID card. After the system administrator reviews and approves it, you can import the student list and teacher list, set permissions, *etc.* The school module includes five major sections and 21 small modules, including “position, student, evaluation, message, and mine”, as shown in Figure 3.

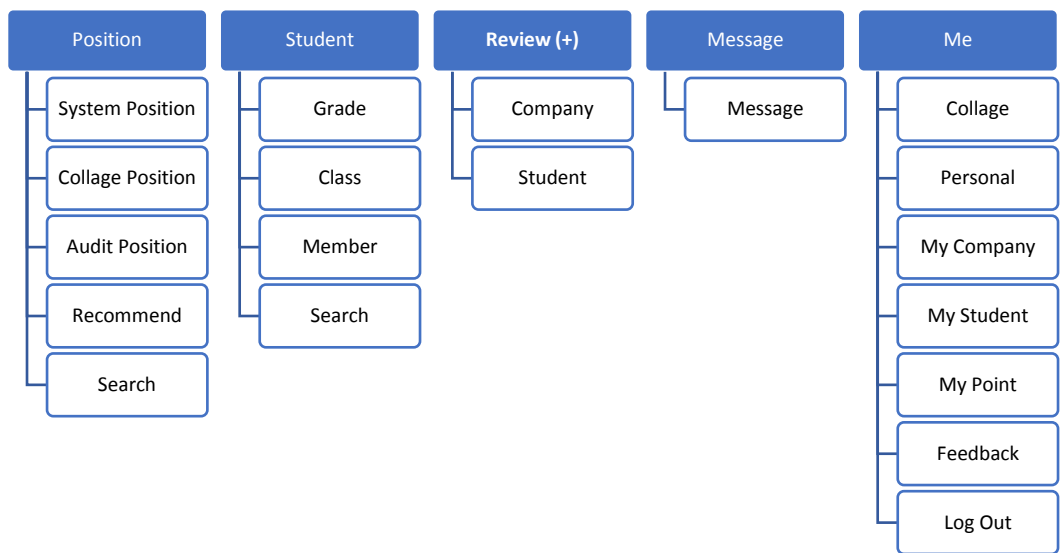


Figure 3. Collage module.

6.4. System services (building bridges and promoting integration)

The work–study system serves schools, teachers and students, enterprises and positions, builds a bridge between enterprise work–study positions and school work–study students [4], and promotes the organic connection and integration of the education chain, talent chain, industrial chain and innovation chain. The system service module includes five major modules and 22 small modules: "school, enterprise, data, monitoring and setting", as shown in Figure 4.

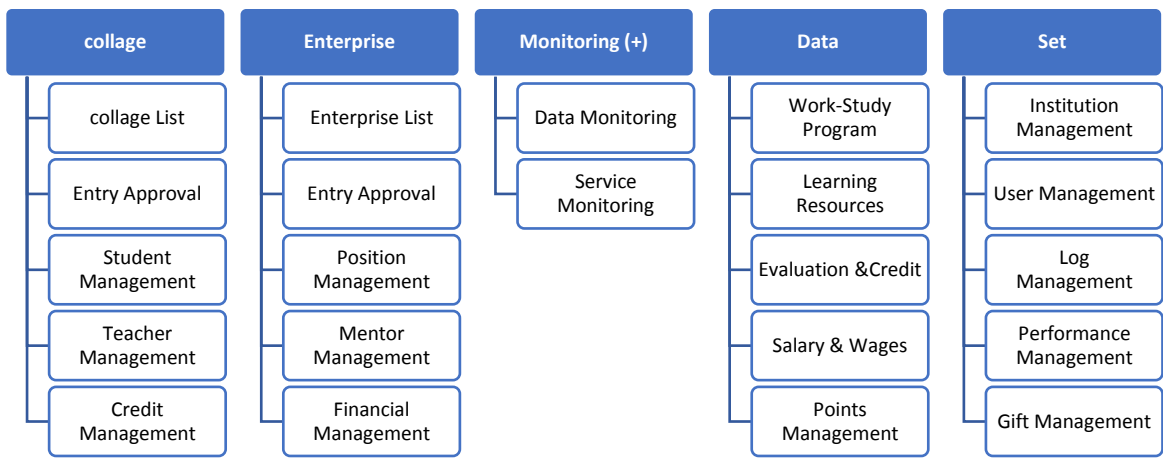


Figure 4. System services module.

## 7. Conclusion and outlook

This paper deeply studies the work–study system in the context of vocational education, and designs a scientific and efficient system solution. This solution covers functions such as job and unit information management, student and school information management, job push and online registration, work–study assessment and evaluation, points rules and remuneration distribution, information communication and rights protection mechanism, data analysis and ability certificate. According to user roles and work processes, the system is divided into four modules: school, student, enterprise, and system service, which fully meets the actual needs of students, schools, and work–study units.

What is particularly important is that the system emphasizes the deep integration of informatization and intelligence, and uses data analysis technology to provide students with accurate online courses and job recommendations, and issue certificates of competency. This innovation not only significantly improves the level of informationization and intelligence in the management of work–study programs, but also provides vocational colleges with a new model for training work–study talents. Looking ahead, we will continue to optimize system functions and improve its application efficiency in order to contribute more to the management of work–study programs in the field of vocational education.

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## Conflicts of interests

The authors declare no conflict of interest.

## Authors' contribution

“Conceptualization, Shigen Zhong; methodology, Alexis John Rubio; software, Mengxian Wang; validation, Shigen Zhong and Alexis John Rubio; formal analysis, Shigen Zhong; investigation, Shigen Zhong; resources, Shigen Zhong; data curation, Mengxian Wang; writing—original draft preparation, Shigen Zhong; writing—review and editing, Alexis John Rubio; visualization, Mengxian Wang; supervision, Alexis John Rubio; project administration, Shigen Zhong; funding acquisition, Shigen Zhong. All authors have read and agreed to the published version of the manuscript.”

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