



Research on Information Platform of University Performance Appraisal Based on Big Data Collection Based on Internet of Things Technology

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Abstract. In recent years, with the continuous advancement of the information construction process, the construction of a college information platform based on the smart campus has attracted people's attention. At the same time, the rapid expansion of the demand for university resources also brings people's vision to the performance of higher education. Big data collection based on Internet of Things technology is widely adopted by high-tech enterprises and applied to information platforms. Besides, it also provides new ideas for colleges and universities education development and talent training. This paper puts forward the idea of using big data collection based on Internet of Things technology to build an information platform for university performance assessment. Therefore, encourage teachers to increase their enthusiasm for scientific research, drive the continuous growth of university employees, and provide technical support for the realization of a more scientific and effective performance management mode. To promote the sustainable development of college education and teachers.

Keywords: Internet of Things · big data · performance appraisal · colleges and universities · information platform

1 Introduction

Most of the year 2022 has passed. The Research on China's Digital Human Resources Report pointed out that under the background of the normalized epidemic situation, the flow of human resources is severely limited and the available human resources are insufficient. Therefore, throughout the country, the enterprise management tool HR Software as a Service (SaaS) industry is developing rapidly [1].

At the same time, the staff structure of colleges and universities is changing. In recent years, Generation Z and Millennials have started to work in colleges and universities. Their career preferences and work patterns are different from those of older employees. Colleges and universities need to find new ways to improve employee engagement.

Therefore, in addition to enterprises and other social institutions, universities and other traditional institutions have an urgent need for digital human resources services.

This paper aims to create a performance management assessment platform based on the SaaS system design concept combined with big data and Internet of Things technology to meet the performance indicators and university performance [2]. On the other hand, overlay other information systems of colleges and universities to improve the efficiency of daily tasks such as school teaching. Finally, more vitality will be injected into colleges and universities to enhance cohesion.

2 Text

2.1 Demand Analysis

Before the design of the performance appraisal system, this paper first analyzes the needs of its customers.

We know that this system is for all staff in colleges and universities, so I will analyze customer needs from three levels, namely, college leaders, college teachers, and staff in the Personnel Department.

University leaders: can manage the information of all teachers at different levels, which is easy to find and manage. You have permission to view the performance appraisal progress interface for strategic planning. College teachers: can protect personal privacy. A timely reminder of performance appraisal time and requirements.

The staff of the HR Department: able to make absolute analysis and form HR grades. Performance objective: maximize the satisfaction of employers, strengthen the scientific research level of universities, and ensure the teaching quality of universities [3].

Big data technology refers to the large amount of data that cannot be analyzed and processed by mainstream software within a reasonable time. However, this is not only about a large amount of data, but also includes the process of effective professional processing under this huge amount of data to realize the value-added process of data [3]. In the process of specialized processing of large amounts of data, it also means that instead of using software analysis in the traditional sense, we are using a more innovative way - using cloud computing distributed processing, distributed database and cloud storage, virtualization technology, which can not only speed up computing but also reduce costs. Cloud computing technology is a new type of computer network technology and a landmark product of the continuous development of the information age [4]. The emergence of cloud computing has opened a new chapter for human development, which means that we have entered the era of big data. The essence of cloud computing is to integrate low-cost computing systems into a computing system with strong computing power through the network, because big data technology can process a large number of complex data [5], we can use structured data, semi-structured data, and even unstructured data collected about college teachers, to improve the quantitative accuracy and effectiveness of college teachers.

The Internet of Things refers to the collection of real object information in real-time through information sensors, global positioning systems, infrared sensors, and other equipment, and then the transmission of this information to the Internet to achieve the

connection between things and people, so that any entity in life can be connected to the Internet, to achieve integrated intelligent management [6].

As the implementation of the Internet of Things will generate a large amount of data, in the process of analyzing a large amount of data, big data technology is required to provide support, and the two complement each other. The IoT system is divided into three layers, namely the perception layer, the network layer, and the application layer. The perception layer of the Internet of Things is responsible for using devices to perceive and detect the situation of entities in various dimensions [7]. The network layer is responsible for acquiring and transmitting the information observed by devices in the perception layer. The application layer is responsible for the connection between the Internet of Things and users. The specific support of big data technology for the Internet of Things is mainly reflected in the perception layer and the network layer.

System design principles: Before designing the system, the following principles should be met. **Systematicity:** ensure the consistency and integrity of the system. **Flexibility;** The system can flexibly adapt to the external environment, and various parameters can be transferred to each other to meet the changing performance appraisal needs [8]. **Flexible integration with other systems.** **Ease of operation:** considering the future development of computer technology and the user, the system shall be designed with a modular structure. The independence of modules is strong, and the increase, decrease or modification of modules has little impact on the whole system, which is convenient for the improvement and expansion of the system so that the system is in the process of continuous improvement and is conducive to the expansion and improvement of the system. **Reliability:** The system should have the ability to resist external interference and strong self-recovery ability. The system shall ensure the accuracy and reliability of data. **Advanced and mature technology is adopted,** which conforms to the specification. **Economy:** Based on meeting system requirements, minimize system overhead.

2.2 Assessment Process

Performance plan: including annual performance target, monthly performance target, performance target of each department, and individual performance target. Next, I will discuss the annual performance target and individual performance target in detail.

Annual performance target:

The purpose of setting up an efficient, fair, and reasonable annual performance target is to improve the school running level, improve the office efficiency and make the university famous. The design performance objectives need to meet the 'SMART' principle [9].

S (Strategic): performance objectives should be consistent with the organizational strategy. The performance target comes from the organizational strategy at first and must be subordinated to the organizational strategy at the same time.

M (measurable): Determine the number and time of performance objectives. Whether and to what extent the performance objectives are achieved must-have criteria and measurement methods that can be accurately determined, easy to measure, and not easily disputed.

Acceptable: Challenging and motivating. The setting of performance objectives should be aggressive, with growth breakthroughs, and reflect the competitive consciousness of surpassing rivals and self, which is an inevitable requirement of modern commercial society.

R (realistic) Realistic and feasible: the goal should not be set too high. It should be modest or it will lead to confusion. At the same time, it should also be challenging to improve the ability level of colleges and universities [10]. Finally, 10% of the people feel pressured, 10% of the people can play more potential to over fulfill the task, and the remaining 80% of the people can complete the task after hard work.

T (timetable) Time-limited: defines the time range of different goals.

Individual performance objectives:

The overall performance appraisal scheme covers managers and faculty groups but will focus on faculty performance appraisal. The system will focus on the characteristics of college teaching, ensure that the scientific research task will not be too heavy to affect the teaching task, and appropriately reduce the burden of college teachers when implementing the personal performance goals of college teachers. The number of scientific research papers is more important than the number.

At the same time, we should pay attention to the construction of teachers' values, and strive to create an example of teachers who are active, enterprising, dedicated, and diligent. For examiners, testing teachers' values is a long-term task, which needs to be implemented in daily life, to ensure that teachers can fully implement the profound connotation of core values.

Establish perfect performance appraisal standards.

Summarize and manage human resource information through big data technology, collect users' evaluation of the performance platform in real-time, and technicians regularly form feedback on the evaluation to repair system loopholes.

The assessment criteria embody several principles:

Transparency principle: everyone can find the appraisal criteria, appraisal process, and appraisal time on the platform. Objective principle: use a big data system to input data throughout the process to prevent omission. Conduct pre-examination training for examiners to improve relevant professional qualifications. Statistics shall be timely and accurate. Communication principle: use sensing technology to strengthen the connection between examiners and examinees. The principle of comprehensiveness: teachers work hard.

First, the school needs to set performance appraisal indicators:

Definition of relevant concepts:

KPI: a key result indicator that can be expressed by quota or ratio. At present, KPI is also widely used in the performance appraisal of colleges and universities, which can guide college teachers to complete teaching and research tasks with high quality and perfect teaching objectives. However, as a result-oriented indicator, KPI will guide teachers to focus on short-term results too much and ignore long-term changes and processes. Therefore, we will combine gs indicators with KPI indicators for comprehensive consideration.

GS: a phased indicator that is difficult to quantify. It refers to the completion of major work that is relatively long-term and has no direct control over the operating results.

The performance appraisal should focus on the process of self-examination of employees. Teachers should position their level in colleges, departments, and schools through horizontal comparison of teaching quality and self-evaluation of the quantity and quality of scientific research achievements. Teachers can judge whether they have made progress in all aspects, what is room for improvement, and simply judge the recent work status by viewing the longitudinal comparison of previous years' performance. In addition, employees need to listen to others' opinions to improve themselves. In the KPI and gs indicators of performance appraisal, there will be leaders' evaluation, colleagues' evaluation, parents' evaluation, students' evaluation of teaching, and other sectors. The experience of the latter two mainly reflects teachers' education level and ethics, which has high reference value.

The indicators are set by the 80/20 principle, adhering to the concept of "fewer but better" in terms of quantity, which is convenient for college employees to focus on their work and improve their work concentration within a certain period.

The establishment process of KPI and gs indicators is very complicated, but each step is indispensable. Therefore, good communication and discussion must be conducted before the establishment. All people involved in the assessment should participate in the meeting to modify the performance assessment rules.

In performance appraisal, weight setting is often very important, and reasonable weight setting can strengthen the rationality and fairness of performance appraisal. Therefore, for the in-service employees in different departments of colleges and universities, KPI indicators and gs indicators have different weights, which also have many considerations. The following three parts of the school are randomly selected for illustration:

Financial Management Department: KPI index accounts for 50%, gs index accounts for 50%. The members of the Financial Management Department will judge the performance level through the utilization rate of financial expenditure in the school, so the KPI accounts for a large proportion.

Top management: KPI index accounts for 80%, gs index accounts for 20%. For senior leaders, the purpose of performance appraisal is to assess their management philosophy and management level. The management level is mainly measured by quantitative indicators such as the completion of subordinate tasks, the quality change of students in a certain period measured by authority, and the performance report of each department in the university. Therefore, the KPI index accounts for a large proportion.

College teachers: KPI index accounts for 20%, gs index accounts for 80%. Only after strict layer upon layer screening can college teachers successfully enter the post. So they have strong professional ethics and a sense of responsibility and can meet the teaching workload on time. Similarly, most of their KPI indicators are difficult to open the gap. On the other hand, the reference significance of qualitative indicators is extraordinary. From the evaluation of others, we can observe the teacher's teaching level, performance ability, personal accomplishment, and other aspects. It is a very good assessment method, so it accounts for a large proportion.

Formation and determination of scoring principles for assessment results:

Set goals, and give a total score of five points. Three points will be given if the task is just completed. Then add up according to a certain model, and five points will be considered excellent.

Personal performance rating: I take work performance (KCL) and comprehensive quality (KPI+GS) as the horizontal axis and vertical axis of the coordinate system respectively to form a rating classification, as shown in Fig. 1 below:

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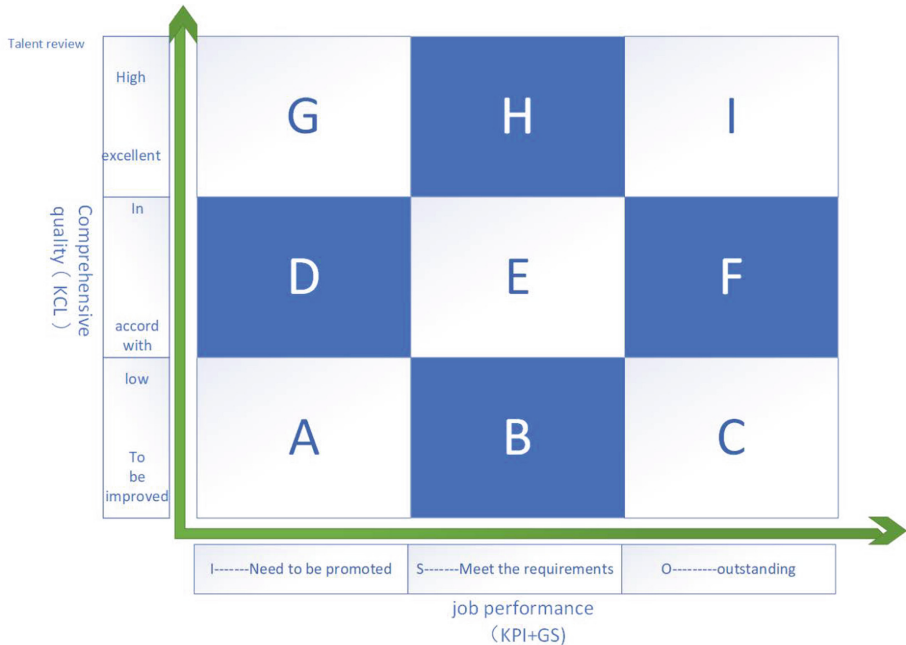


Fig. 1. .

Level A: The losers at this level will face job transfer or immediate elimination.

Level B: For those with problems, stop all opportunities and rewards, strictly require the ability and quality, participate in training, enter the observation period of performance, consider how to deal with the next step, and consider salary reduction.

Level C: The promotion opportunity will be suspended for those with deficiencies. They will be given a year’s opportunity to improve their ability and quality, and require staff to participate in training and learning.

Level D: Those with problems should stop all opportunities and rewards, be strict in performance, participate in training and learning, enter the observation period, consider how to deal with the next step, and consider salary reduction.

Level E: Those who perform fairly well should carefully consider salary reduction and promotion, put forward performance requirements, and conduct training to improve their ability, but do not let them hinder the development of talented employees in the department.

Grade F: excellent, reward: more salary increase, encourage: continue to improve quality, opportunity: have the conditions for the promotion.

Grade G: The promotion opportunity will be suspended for those with deficiencies. They will be given a year’s opportunity to improve their ability and quality, and require staff to participate in training and learning.

Level H: excellent, reward: more salary increase, encourage: continue to improve quality, opportunity: have the conditions for the promotion.

Level I: Very excellent person, with various opportunities and rewards, high salary increase bonus, priority for promotion if continuously obtained, and other rewards.

Preliminary determination of performance appraisal scoring steps: KPI indicator scoring; Gs index scoring; Absolute Appraisal: the appraisal score is obtained from the weight summary [13]; Relative appraisal: appraisal: check and summarize employee grades; Result confirmation: the appraiser and the appraisee talk one-on-one to determine the appraisal results and performance grades.

Counseling and training before the examination: First, the school shall convene leaders of teaching units, administrative departments, and logistics departments for meeting mobilization. Next, the tutoring and training of each department should be carried out to ensure that each teacher has clear performance goals and how to implement personal work goals [14]. The work goal will be the direction of every teacher's efforts throughout the daily work of teachers. At the same time, all teachers should be aware of the information such as the indicators, the time of each task, and the inspection period. To understand the level you need to reach finally. After coaching and training, each teacher shall sign for confirmation. And meet the needs of teachers who are not competent but want to improve their performance, and provide them with relevant training.

The technical departments of colleges and universities need to improve the supervision mechanism, use big data technology to enable assessment and supervision, make full use of modern information technology, and rely on big data, artificial intelligence, and other means to run through disciplinary supervision, inspection, and supervision [15]. And we should improve the rules and regulations to prevent loopholes in the system. The above two nights can guarantee the accuracy of the assessment to the highest extent.

This system can collect attendance information, reward and punishment records, and other information across platforms. Ensure the accuracy of collected information and the continuous automatic collection of long-term information. Tables and various statistical charts can be automatically formed, and a brief analysis report can be formed through big data analysis for the reference of the HR Department.

The formation of assessment results will adopt the mode of "human-computer integration", that is, artificial intelligence replaces some of the examiner's functions, which can effectively avoid unfair and objective assessment results caused by the subjective impression and personal style of the examiner.

The confirmation of appraisal results mainly involves the following processes. The assessment results will be publicized by each department on a unified date. If teachers have objections and need to report them, they will review the parts with objections and re-identify them. After all the assessment results are confirmed, they will be reported to the school for approval and archiving.

The ultimate purpose of any performance appraisal is not only for testing but also for the ultimate development of college teachers and colleges. Therefore, after the confirmation of appraisal results, performance results must be analyzed and fed back [16]. Excellent performance results analysis and feedback can not only increase the enthusiasm of teachers but also help employees improve their performance. The analysis of performance results should reflect the vision and requirements of schools, students, and other groups for teachers. It should also indicate the objectives of the school managers

for the next stage of performance and the detailed plans made for this purpose. The system will use information technology to analyze the data of the assessment results and assist in decision-making.

Convening performance analysis meeting: anonymous questionnaire survey was issued to college teachers to evaluate and suggest a performance appraisal. Relevant personnel absorbed opinions and formed a report, which was submitted together with the performance appraisal analysis report at the meeting [17]. On the other hand, the leader in charge should have strong communication ability, be able to actively communicate, and consciously collect opinions. At the meeting, all members of the meeting focused on discussing and correcting problems in the performance appraisal body and appraisal process. And discuss the performance objectives and work tasks of each department in the next stage.

Link with salary: salary is often the most concerned issue of every employee [18]. The performance results will be linked to the salary payment. The performance appraisal team and relevant appraisers can adhere to the principle of fairness and justice to pay teachers. The appraisal team takes the performance salary as the bonus part of its performance appraisal salary allocation.

Learning and training: After the confirmation of the performance appraisal results, teachers with poor performance levels need to participate in the performance improvement training organized by the school. Teachers with ordinary performance who wish to learn can also apply for training [19]. When there are limited learning exchange opportunities and training (provincial training and national training), teachers with excellent performance are preferred.

Professional title employment: the role of performance appraisal: the school will adjust the professional title employment and salary grade according to the performance level. The school will focus on training teachers with excellent performance appraisal results and give them extra points for their professional titles. When there are vacancies in school management posts, these teachers will be considered first. The following is part of the role of performance appraisal: to understand the ability level, strengths, and weaknesses of employees. This is conducive to the follow-up training of employees, personnel transfer, and other activities. In the training, it can make up for the lack of employees' working ability and improve their working quality [20].

At the same time, performance appraisal is also an effective means to motivate employees. It can create a benign competitive environment and improve teachers' motivation. Finally, the rational use of performance levers can realize the sustainable development of vocational education and help the strategy of rejuvenating the country through science and education.

2.3 Database Design

First, the feasibility of the system is analyzed.

Economic feasibility: The school is in good financial condition and able to bear the cost of system purchase and later maintenance [21]. Operational feasibility: the platform is divided into foreground operation and background operation. The front desk uses photoshop and other software to design beautiful web pages for users. It can be used in Windows systems for easy downloading. The system page is simple, the font size is

adjustable, and the presbyopia users can also read it smoothly. It is easy to operate, and older teachers who are not good at using electronic devices can quickly learn and put them into use.

Technical feasibility: it is necessary to determine the development of the system through the analysis of economic, social, technical, and other aspects.

Analyze the user activities of university performance appraisal and form a business flow chart as shown in Fig. 2 below [22].

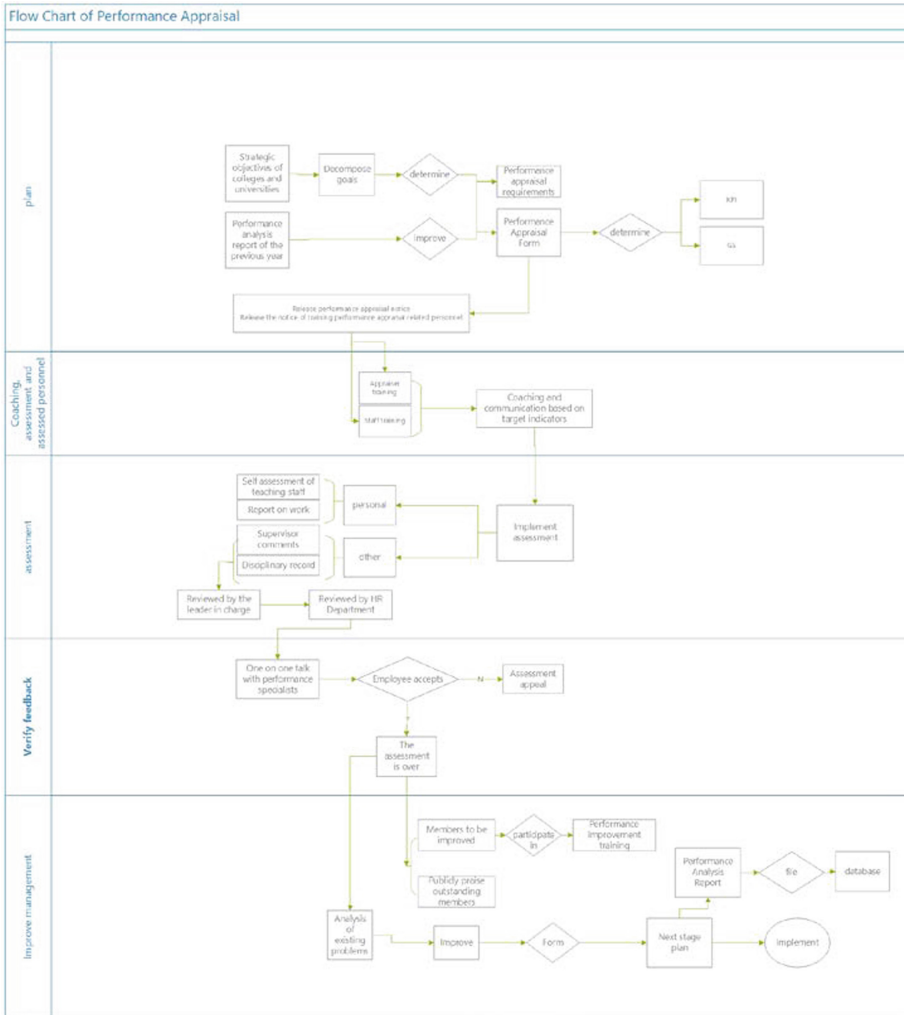


Fig. 2. .

Conceptual model: form ER diagram (entity contact method), as shown in Fig. 3, 4, 5 and 6 below:

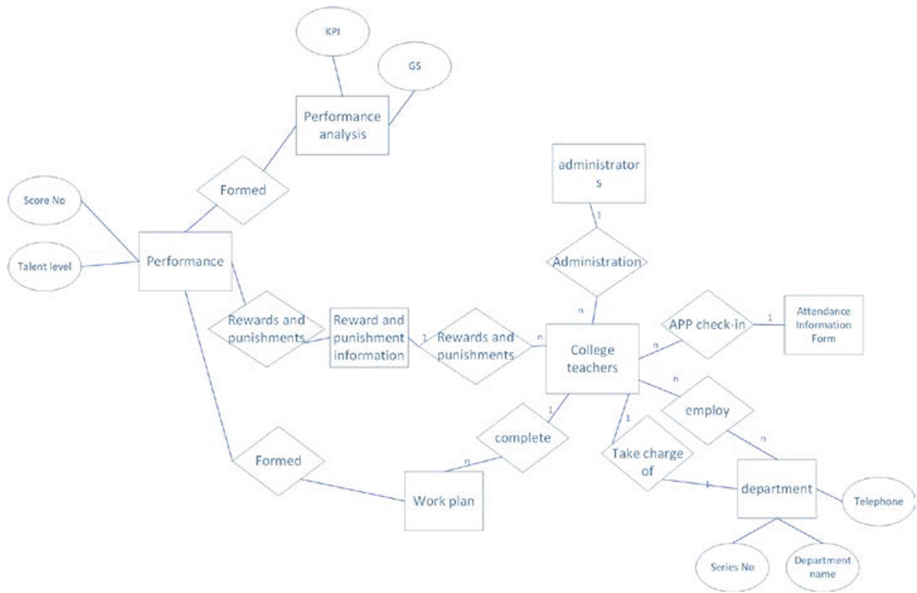


Fig. 3. .

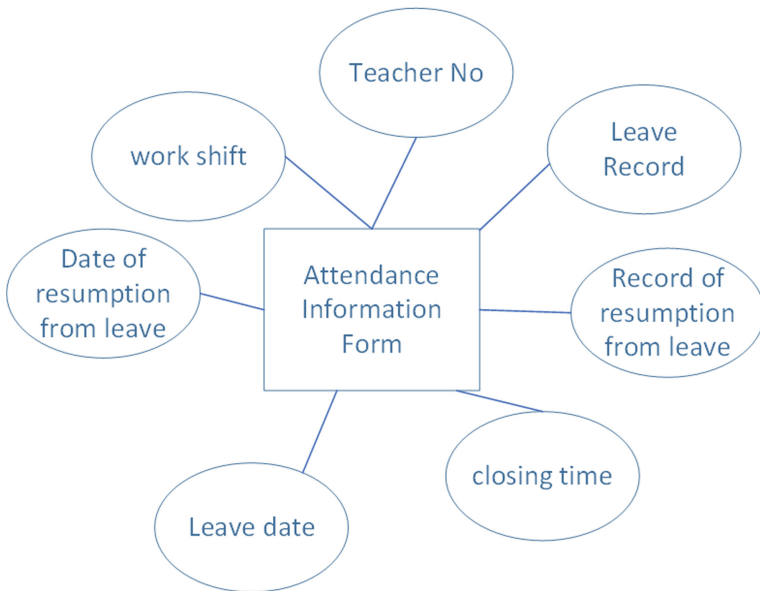


Fig. 4. .

The main functions of establishing a university teacher performance management database are:



Fig. 5. .

Teachers' information management: adhere to the principle of protecting personal information for the management of teachers' personal information, reduce the risk of information disclosure, and the information entered on the platform is comprehensive, can be updated in real-time, and is easy to find. Individuals can click to generate information analysis, including the queries of previous years' performance, multi-level retrieval of a large amount of information, statistical analysis of individual compensation, etc. [23].

Attendance information management: the system will summarize and count the attendance information of all teachers, such as attendance, absence, leave, overtime date and working hours, etc. within a period, analyze the system, and finally form a report. It is convenient for the human resources department to master the working status of teachers in real-time. The assessment subject is the Human Resources Department. The system collects data and downgrades teachers who ask for more leave, exceed the upper limit of late and early leave, and whose attendance is less than half of the total days due to maternity leave, an entry in the month, and resignation in the month, and cancels the performance bonus of the month. Reward and punishment information management: this system will focus on building a more perfect reward and punishment mechanism. Teachers can add, delete, cancel and view reward information individually or in batches on the platform. The administrator has the right to review the reward and punishment information [24].

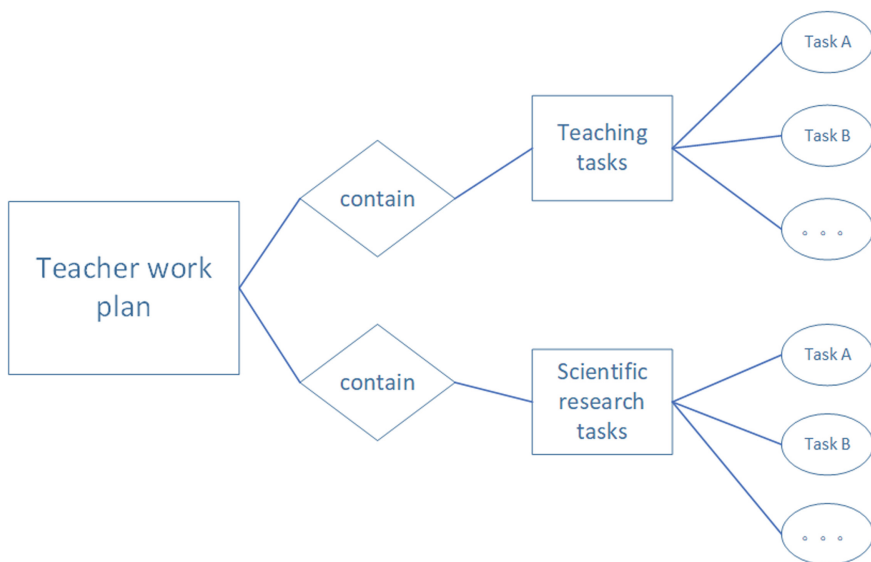


Fig. 6. .

A performance appraisal system based on the saas mode has been established [25]. Different users (different universities) can only open the browser to assess, view, manage and analyze the performance of hundreds of people [26]. This is a public platform, which can be personalized for different universities to meet different needs [27]. At the same time, each user will not be aware of the existence of other users. The prototype analysis method is used to pay more attention to the details of each module of the user interface, adapt to the needs of users in continuous improvement, and strive to give users a more comfortable experience. The system adopts the development method of separating the front end from the back end. The back end provides data to the front end, and the front end is responsible for HTML rendering and user interaction. Both parties standardize the interface content in the form of documents [28].

The front end uses Vue with node. of as the core Js front-end technology ecological architecture. The back-end uses spring boot+spring cloud+spring mvc+spring data. The front and rear ends use API documents to connect. After the front and rear ends are built, the front and rear ends are jointly tested.

Design Oracle or MySQL databases to support more tenants.

3 Conclusion

With the further development of higher education in the new era, the competition among universities across the country is becoming increasingly fierce. The importance of performance appraisal as a means to enhance the core competitiveness of universities is self-evident. At this time, build a high-tech performance appraisal information management system to optimize the overall performance appraisal. High-quality performance appraisal can better adapt to the concept of running a university in the new era, better

meet the development goals of universities, and encourage teachers to work towards the same goal [29].

This paper finds that in recent years, China's higher education industry has made great progress, the system is more sound, the team of teachers is growing, and the requirements for teachers are higher. At the same time, the salary is diversified, and the performance appraisal is also improving. The system design must conform to the development of the times and the unique background of colleges and universities, and seek development in the change.

The research still has some limitations, and there are many difficulties in the research process. The system design process needs to be further improved and supplemented in the future.

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