Education Reform and Development, 2024, Volume 6, Issue 9
https://ojs.bbwpublisher.com/index.php/ERD
Online ISSN: 2652-5372
Print ISSN: 2652-5364

Research on the Construction of Vocational School-Enterprise Cooperation Service Platform Based on Micro-services

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Abstract: With the deep integration of school-enterprise cooperation in higher vocational colleges, it is necessary to use micro-service technology for targeted analysis of various behavioral data involved in school-enterprise cooperation, and extract valuable information as the basis for guide school-enterprise cooperation work, to shift school-enterprise cooperation work from "business-driven" to more precise "data-driven" [1]. This article uses big data analysis as a means, adopts micro-service technology, and takes school-enterprise cooperation and industry education integration as the concept. Through the needs analysis of the college, the overall architecture of the school-enterprise cooperation service platform is designed. From business processes, big data analysis and intelligent visualization, the deep integration of school-enterprise joint training of teachers, school-enterprise collaborative teaching, and school-enterprise joint promotion of employment are achieved, and the expected effect is worth promoting.

Keywords: School-enterprise cooperation; Big data; Micro-services; Integration of industry and education; Curriculum reform

Online publication: September 25, 2024

1. Introduction

Deepening school-enterprise cooperation and promoting deep integration of industry and education are important strategic choices for the development of vocational education. The current mode of school-enterprise cooperation in vocational colleges is mainly led by schools and enterprises, actively promoted by the government, and guided by industry participation. Given the different interests and needs of various cooperating entities, vocational colleges have less involvement in project cooperation, collaborative innovation, achievement transformation, employee training and skill assessment, and effective information communication and project management channels between schools and enterprises still need to be improved. To further promote, standardize and ensure the cooperation between vocational colleges and enterprises and to play the main role of enterprises in vocational education, relevant departments, industries and enterprises must build an

interconnected information platform for school-enterprise cooperation jointly [2]. To meet the current cooperation between schools and enterprises, it is important to break down communication barriers, better understand the needs and expectations of enterprises for talents, adjust the curriculum, teaching content and talent cultivation plan according to actual needs and cultivate skilled talents that better meet the requirements of enterprises and adapt to industrial development. Besides, striving to achieve greater gradient development for both parties, achieving strategic win-win and building a school-enterprise cooperation service platform is very necessary [3].

This article combines the actual situation of the college, starting from the analysis of the needs of the school-enterprise cooperation service platform, designs the overall architecture, business processes and intelligent data processing, and considers the functions and performance from the aspects of big data management, micro-services, data visualization, etc. This article aims to build a school-enterprise cooperation service platform under the deep integration of industry and education, to promote the sharing and transformation of innovative activities and scientific research achievements in vocational college school-enterprise cooperation, promoting more communication and interaction between schools and enterprises, establishing an open, mutual trust and win-win cooperation culture, laying the foundation for long-term cooperation and forming a good school-enterprise cooperation and integration ecology [4].

2. Design of school-enterprise cooperation service platform

2.1. Requirement analysis

By researching the responsibilities and interests of various participating parties in school-enterprise cooperation, the study can be analyzed from four perspectives: government, vocational colleges, enterprises and industry.

(1) From the perspective of government planning, the deep integration of school-enterprise cooperation can improve education quality, promote employment, integrate industry and education, innovate technology, serve regional economic development and transform and upgrade the industrial chain.

(2) From the perspective of vocational colleges, deep integration of school-enterprise cooperation can improve the quality of talent cultivation, increase student employment rates, enhance the level of teacher-team construction and strengthen social service.

(3) As an enterprise, deep integration through school-enterprise cooperation can recruit high-quality skilled talents, enhance employee training and education, transform achievements, collaborate on technological innovation, and expand the company's visibility [5].

(4) From the perspective of industry norms, the development of industry standards through school-enterprise cooperation, employee skill assessment, personnel training and education enhancement, and the enhancement of industry influence.

The interests and demands of each participating entity vary greatly. Based on actual needs, when constructing a school-enterprise cooperation service platform, the study considers starting from different modules [6].

2.2. Overall architecture design of school-enterprise cooperation service platform

When designing the overall architecture of a general system platform, a modular design concept is generally adopted. However, this architecture design has many network security issues such as high code segment coupling, data quantification management aggregation, low data storage scalability and high risks of modular deployment, which cannot meet the needs of school-enterprise cooperation service platforms in the current big data environment. Given the above factors, the study introduces the architecture design concept of micro-services, which involves breaking

down applications into small, independent, deployable and manageable service architectures [7]. Each design has a complete set of features and a maintainable code repository and can be deployed and maintained independently of other services. The micro-service architecture has the characteristics of technological diversification, controllable granularity, powerful expansion, decentralization, rapid development and autonomous application [8]. The school-enterprise cooperation service platform adopts a micro-services architecture design, mainly composed of three parts: user end, running environment, and API interface, as shown in **Figure 1**.

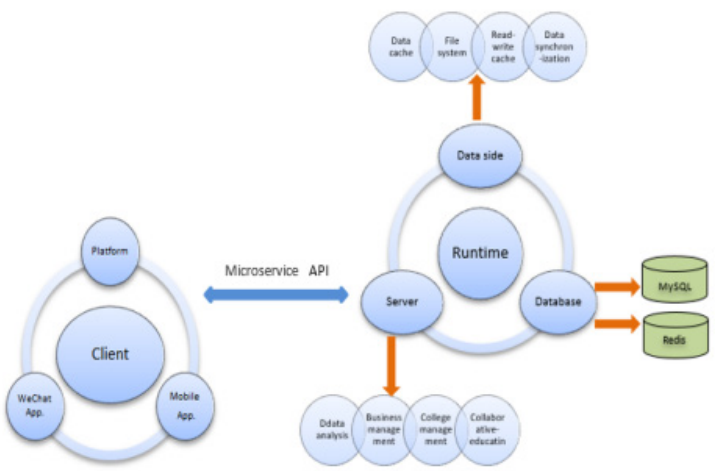

Figure 1. System architecture of school-enterprise cooperation service platform.

The operating environment of the school-enterprise cooperation service platform includes three independent service architectures: database, data side, and server side. It adopts Docker container technology and is deployed in cloud servers, which can provide convenience for later maintenance [9].

(1) The database adopts mature MySQL technology and uses Redis technology to cache and process data.

(2) The data end mainly realizes the functions of data caching, file system, read/write caching and data synchronization, providing effective data for the server.

(3) The server uses API interfaces provided by micro-services technology to divide the school-enterprise cooperation service platform into four micro-service groups based on different business functions: data analysis, enterprise management, college management and collaborative education management. Each service group is deployed separately and deployed services need to register their service name and address. After successful registration, they can be remotely called using a unified API interface. The school-enterprise cooperation service platform function can be used on the browser platform website, mobile app and WeChat mini program [10].

2.3. Big data processing of school-enterprise cooperation service platform

The mature development of big data technology provides strong technical support for the creation of school-enterprise cooperation service platforms. By collecting and organizing system and business data on the platform, potential and valuable data in school-enterprise cooperation can be explored, to assist in guiding the smooth implementation of school-enterprise cooperation in the future and achieving a more precise shift from "business-driven" to "data-driven" school-enterprise cooperation. In the design of data processing, to meet the business needs and basic functions of data analysis for the school-enterprise cooperation service platform, the

study analyzes and processes the data in four layers, as shown in **Figure 2** [11].

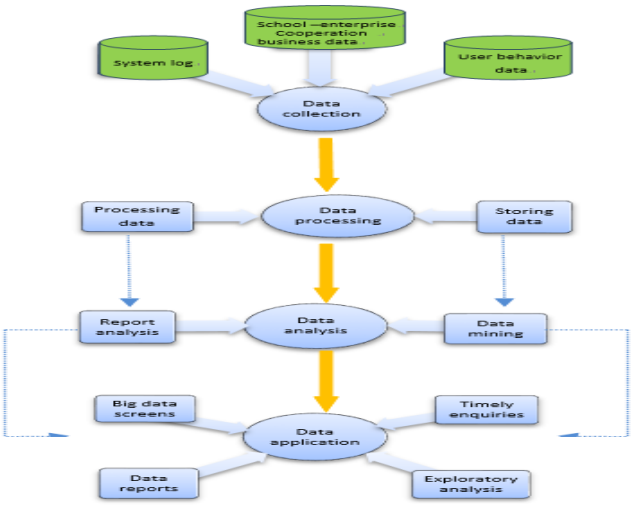

Figure 2. Data processing and analysis design.

(1) Data collection layer: Mainly collects business data sources, user behavior data sources and system log data sources generated in school-enterprise cooperation and implements them through a combination of offline and real-time collection.

(2) Data processing layer: Clean, filter, cluster, classify, associate and normalize the collected data according to the different business needs and scenarios of school-enterprise cooperation and persistently store the processed data.

(3) Data analysis layer: Mainly composed of report analysis and data mining, where the data analyzed in the report comes from the processing data in the upper layer and the objects of data mining come from the stored data in the upper layer. Utilize Python, reports and BI data analysis tools to fully explore the connections and potential patterns between data and determine visual information and indicators based on the analysis results.

(4) Data application layer: Divide corresponding categories of applications according to the needs of different businesses and visualize the final data, such as data reports, digital screens, timely queries, exploration and analysis. At the same time, select appropriate visualization types based on the obtained analysis results, such as line charts, bar charts, pie charts, heat maps, etc. [12]

3. Implementation of the functions of the school-enterprise cooperation service platform

The school-enterprise cooperation service platform is developed using a front-end and back-end separation approach. Under the Spring Cloud micro-services framework technology, the front end uses the HTML + Css + Javasprint framework, the back end uses Springboot + Mybatis + MySQL, and the data caching uses Redis [13].

3.1. Implementation of micro-service scheduling algorithm

The micro-service scheduling algorithm is the most core component of building a micro-service platform, mainly responsible for reasonably allocating various business requests to available micro-service instances to

achieve load balancing and high availability of functions. The commonly used scheduling algorithms currently include polling method, random method, consistency hashing method, minimum connection method, minimum response time method, etc. This platform uses a weighted polling algorithm to schedule micro-services based on servers' business request services' characteristics and relevant configuration [14]. In the weighted polling micro-service scheduling algorithm, whenever a new round of scheduling is conducted, the system will select micro-service instances based on their weights, and instances with higher weights will receive more requests to achieve load balancing. Adjust weights and algorithms according to specific scenarios to meet system requirements. The pseudocode of the scheduling algorithm is shown in **Figure 3**.

```
function calculateTotalWeight():
    totalWeight = 0
    for service in services:
    totalWeight += service.weight
function weightedRoundRobinScheduling():
    currentIndex = -1
    maxWeight = max(service.weight for service in
    services)
while true:
    currentIndex = (currentIndex + 1) % len(services)
     if currentIndex == 0:
    calculateTotalWeight()
    if services[currentIndex].weight >= maxWeight:
    return services[currentIndex]
for i in range(number_of_requests):
selectedMicroservice = weightedRoundRobinScheduling()
    response = selectedMicroservice.handleRequest()
    processResponse(response)
```

Figure 3. Pseudocode of the scheduling algorithm.

3.2. Implementation of visualization for school-enterprise cooperation service platform

Data visualization is the most important function of the intelligent service platform for school-enterprise cooperation. By organizing and analyzing data, it provides decision support for the further development of school-enterprise cooperation. The school-enterprise cooperation service platform involves cooperation enterprise information, school-enterprise cooperation project management, employee training, internship and practical training, enterprise recruitment, social services and other aspects. In the actual operation process, it will generate a lot of data. By organizing, statistics and analyzing these data, potential information in school-enterprise cooperation can be explored, providing data support for the deep integration of school-enterprise cooperation. ECharts is an open-source library for data visualization charts, based on JavaScript technology, which can provide intuitive, vivid, interactive and customizable data visualization charts. It is widely used in data visualization. ECharts has a very rich display of legends, providing not only conventional line charts, bar charts, scatter plots, pie charts and K-line charts, but also box charts for statistics, maps for geographic data visualization, heat maps, etc. The study now uses the rich charts provided by ECharts to display the data processed and analyzed by the school-enterprise cooperation service platform through a large data screen, which can intuitively display the current number of cooperative enterprises, the number of internships participating in cooperative enterprise positions, the number of school-enterprise cooperation projects and the number of achievement conversions. Besides, the study also displays information on cooperative enterprises over the years, employee training, school-enterprise cooperation projects, student internships and employment in cooperative enterprises through charts. By visualizing data analysis charts, the current situation and existing

problems of school-enterprise cooperation can be understood, providing ideas for the deep integration of school-enterprise cooperation in the future [15].

The large amount of effective data generated through the school-enterprise cooperation service platform can intuitively analyze the number of internships, employment salaries, turnover rates and other information of students in cooperative enterprises. It can also grasp the employment situation, quality and future employment trends of students in cooperative enterprises, explore the deep reasons behind the data background and take relevant measures to strengthen school-enterprise cooperation. By utilizing data such as achievement transformation, technological collaborative innovation, number and amount of cooperation projects, skill appraisal, employee training, and teacher training, the quality of school-enterprise cooperation can be enhanced, continuously improving high-quality cooperation projects and supplementing insufficient cooperation, thereby improving the efficiency of university cooperation. Through the school-enterprise cooperation service platform, analyze the collected data, fully explore the correlation and potential patterns between data in school-enterprise cooperation, and continuously improve the level and quality of school-enterprise cooperation.

3.3. Stability testing of school-enterprise cooperation service platform

Before the trial operation of the school-enterprise cooperation service platform, it is important to conduct functional and performance tests on the system, mainly to test whether the platform can achieve the functions required by the requirement analysis, as well as whether the system can operate normally and understand its performance. Through functional testing, all functions of requirement analysis have been implemented on the platform. The platform performance requirements mainly include supporting 200 concurrent users for each function of the system, with a response time of no more than 5 seconds, and a resource utilization rate of no more than 75% for each server. The system has a certain degree of reliability. The study used JMeter performance testing to test the performance of our platform. Through the testing, the platform's performance and reliability tests met user needs and the system ran stably for 7 × 24 hours.

4. Conclusions

The deep integration of industry and education and the deepening of school-enterprise cooperation are important measures for promoting the development of vocational education in China. This article takes the cooperation between Hanzhong Vocational and Technical College and enterprises as an example. Through big data analysis, combined with micro-service technology, and based on the concepts of school-enterprise cooperation and industry education integration, the demands of various stakeholders in school-enterprise cooperation are analyzed. An intelligent school-enterprise cooperation service platform is constructed, and from the perspective of business processes, big data analysis, and intelligent visualization, the deep integration of school-enterprise joint training of teachers, school-enterprise collaborative teaching, and school-enterprise joint promotion of employment is achieved. The full process and all-round management of school-enterprise cooperation is carried out. At present, the trial operation of the system is normal, and the management of school-enterprise cooperation information has achieved the expected effect, which is worth promoting.

Funding

Hanzhong Vocational and Technical College, "Education Reform Project" (Project No.: HZYKYYB2023009)

Disclosure statement

The authors declare no conflict of interest.

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