

Research Article

WBS-Based Method in Teaching Management Information Project

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In modern times, with the development of industrialized society and the invention of clocks and watches, people have become more and more concerned about institutionalization, and higher education time and space have also shown the characteristics of institutionalization. In modern times, educational informatization has brought challenges and opportunities for educational reform and development. The vigorous development of education informatization has also produced changes in higher education spatiotemporally. For example, the rise of catechism and online learning, the importance of fragmented time, the development of space toward virtualization, and the expansion of interactive space for interpersonal interactions. In addition, the enrichment and sharing of educational materials, the informatization, and big data of educational management also contribute to the improvement of time efficiency and optimization of time structure in higher education. With the background of education under the new normal, this paper briefly analyzes the current situation of education informatization construction in colleges and universities from the perspective of education managers, and addresses the current situation and problems of teaching management informatization construction, such as organizational structure dominated by pyramidal functional departments, inefficiency, inability to connect work, difficulty in work gap, difficulty in horizontal coordination, and closed information. A work breakdown structure (WBS) based project management theory and work structure decomposition method are proposed. This paper finds that the improved association rule mining algorithm can improve the efficiency of teaching management practice in colleges and universities by more than 14.58%, which is an important reference value for college management informatization.

1. Introduction

Vocational education is an integral part of China's education system and is a special form of education [1]. In the field of development, vocational education crosses the three boundaries of industry, occupation, and education; and in the division of education levels, vocational education is divided into primary, secondary, as well as higher levels [2]. In 2005, the Ministry of Education issued the Decision of the State Council on Vigorously Developing Vocational Education, which pointed out that "the construction of education informatization should be strengthened and the application of modern educational technology in education teaching should be promoted," which initially put the development of informatization on the charter of vocational education development and vigorously promoted the

development of vocational education informatization [3]. Since the release of the Ten-Year Development Plan for Education Informatization (2011–2020), China's education informatization has stepped into a new stage of development, and the strategic status of education informatization has reached an unprecedented new height [4]. Education informatization has become an important part of the process of education modernization, and it has become a strategic goal to promote the reform and development of education in China by accelerating the process of informatization and driving education modernization with education informatization [5]. From 2011 to 2015, China issued the Opinions of the Ministry of Education on Accelerating the Development of Vocational Education Informatization (2012), the Construction Plan of Modern Vocational Education System (2014–2020), the Decision of the State Council on

Accelerating the Development of Modern Vocational Education (2013), the Specifications for the Construction of Digital Campus in Vocational Colleges and Universities (2014), and the Plan on Deepening Several Opinions on Deepening Teaching Reform of Vocational Education and Comprehensively Improving Talent Cultivation Quality (2014), "Guidance on Comprehensively and Deeply Promoting Education Informatization during the 13th Five-Year Plan" (2015), "Action Plan for the New Development of Higher Vocational Education Plan (2015–2018)" and other policies [6, 7]. The development of vocational education informatization has gradually shifted from the primary development stage to the in-depth development stage, which is not only a major development opportunity but also a great challenge for higher vocational institutions [8].

At present, there are some achievements in the research related to education informatization in China, but it is still in the initial stage [9]. The research in vocational education informatization lags behind the research in basic education informatization and higher education informatization [10]. With the continuous development of China's economy and technology, the original system, structure, and talent training mode of vocational education can no longer adapt to the rapidly developing Chinese economy and the rapidly changing industrial structure, and the original vocational education must be reformed and developed, otherwise it will be difficult to adapt to the development needs of modern society [11]. Vocational education informatization is a huge push to promote the reform and development of vocational education. To make the work of vocational education informatization develop in a fast, appropriate and steady direction, it is necessary to continuously understand the current development level of vocational education informatization in each region to provide a reference basis for the promotion of vocational education informatization nationwide [12]. With the ultimate goal of better promoting the construction of educational informatization in higher vocational colleges in our region, this study takes the requirements put forward in the Opinions of the Ministry of Education on Accelerating the Development of Vocational Education Informatization as the purpose, combines the local characteristics of regional vocational education, analyzes the current situation and problems of educational informatization in higher vocational colleges, puts forward improvement measures and suggestions, and provides better educational informatization construction work for each higher vocational college reference [13].

2. Related Work

An important prerequisite for any concept to be of use is that it has a relatively clear connotation and extension. The concept of education informatization was first introduced in the United States in the 1990s [14]. In the 1990s, the U.S. government proposed the "information superhighway" plan in the "National Information Infrastructure" (NII for short) [15]. The plan is to promote the development of an integrated information service system with the Internet as the core and to promote the extensive application of

information technology in various fields of society, especially the application of information technology in education and the deep integration of information technology and subject teaching as an important way of education reform [16].

At present, the term education informatization has been widely used in China and is recognized by experts and scholars. However, the connotation of the concept of educational informatization is diverse, and domestic experts and scholars who have studied educational informatization have put forward their own understanding [17]. Throughout, various scholars have defined the concept of educational informatization from their own perspectives, and the central idea is the same, that is, the application of information technology to education [18]. Specifically, from the technical level, educational informatization can be the integration of digital, networked, intelligent, and multimedia education; from the educational level, educational informatization is a new educational concept with openness, sharing, interactivity, and collaboration, and we can regard educational informatization as a process of pursuing information-based education [19]. In summary, educational informatization aims at the development of students' abilities, the improvement of teachers' professional abilities and teaching standards, the sharing and use of global educational resources, and the overall development of schools [20]. The statistics of word frequencies revealed that infrastructure, informatization resources, teachers' informatization ability, management, and input, teaching, and talents were used more frequently, indicating that the research content of the existing studies was mostly investigated from these aspects.

Vocational education informatization is an important foundation and component of education informatization and national informatization, and [21] defined vocational education informatization as "the process in which teachers and students of vocational education use information technology to promote the teaching reform and development of vocational education on the basis of the network environment, so as to modernize vocational education and meet the needs of the times and society." [22] argued that vocational education informatization should be based on complete computer equipment and the Internet, and that vocational education informatization is oriented to vocational education, and its purpose is to improve the application of information technology among teachers and students in vocational institutions, so as to promote the development of vocational education teaching and reform. According to [23], the connotation of vocational education informatization mainly includes: vocational education informatization should be based on complete computer equipment and the Internet; vocational education informatization is oriented to vocational education, and its task is to improve the application of information technology so as to promote the development of vocational education teaching and reform; the quality of teachers in the information environment is the key to the success or failure of vocational education informatization; educational information resources. The development and construction of educational information resources is the basis and the main task to realize the continuous improvement of educational

research level and educational teaching effect. [24] pointed out that “vocational education informatization refers to the use of multimedia and network information technology in the field of vocational education to promote the comprehensive reform of vocational education and adapt it to the new requirements for the development of vocational education in the informatized society.” It is believed that the purpose of vocational education informatization is to promote educational reform; therefore, from regulations, policies, resources, talents, etc. related to vocational education informatization are all aspects of the development of education informatization. [25] interpreted informatization and education informatization from the perspective of information flow, analyzed the concept of informatization and the evolution of its connotation, and analyzed the differences between the concepts of education informatization and higher education informatization, and he believed that “higher education informatization refers to the use of contemporary information technology to transform the higher education system.”

As shown above, it can be said that the informatization of vocational education is a process that is reflected in all aspects of vocational education and teaching. Specifically, it is a systematic project to modernize vocational education by using advanced educational concepts as guidance, applying modern information technology, and focusing on developing and utilizing information resources in order to cultivate innovative talents who can adapt to the requirements of the information society and accelerate the realization of vocational education.

3. Architecture

At present, there are six modules in the management information project of colleges and universities, including personnel management, teaching plan management, academic affairs management, grade management, financial management, and student registration management, and each module corresponds to different functions [17]. The management of student information and teacher information, teaching plan management, academic affairs plan management, grade management, financial management, and student registration management (as shown in Figure 1).

The organizational structure of the university MIS project (shown in Figure 2).

The WBS diagram of a college management information system project can be divided into four levels [18]. The second level is decomposed into six modules according to the stage of project implementation [19]; the third level of each module is decomposed according to the product composition of the project [20]. The specific WBS tree diagram (shown in Figure 3).

A digital campus is a virtual educational environment based on digital information and networking, which is established on the computer and network technology for the collection, processing, integration, storage, transmission, and application of campus information such as teaching, research, management, technical services, and living services, so that digital resources can be fully and optimally utilized. By

realizing the digitalization of everything from the environment (including equipment, classrooms, etc.), resources (such as books, lecture notes, courseware), to applications (including teaching, learning, management, service, office, etc.), digital space is constructed on the basis of the traditional campus to expand the time and space dimensions of the real campus, enhance the operational efficiency of the traditional campus, expand the business functions of the traditional campus, and finally realize the comprehensive informatization of the educational process in order to achieve the purpose of improving the management level and efficiency. Therefore, the ultimate goal of digital campus construction is to realize education informatization, and digital campus construction is the means for higher education and vocational institutions to realize education informatization.

The platform has established 13 subsystems, including the multimedia information release subsystem, asset management subsystem, teaching task inquiry subsystem, classroom inquiry subsystem, online assessment subsystem, and life service system, which can meet different usage needs in the face of different users. Students, teachers, and evil managers of the college can use the platform to manage their own learning, teaching, and business matters. As shown in Figure 4 and Figure 5.

4. Improved Association Rule Mining Algorithm

To generate all frequent sets, the Apriori algorithm uses a recursive approach, as follows:

$K_1 = (\text{large } 1\text{-itemsets}).$

For $(l=2: K_{l-1} + \mu: l++)$ do begin.

$A_l = \text{Apriori-gen}(K_{l-1}) \parallel \text{Candidate set.}$

For all transactions $t \in B$ do begin.

$A_t = \text{subset}(A_l, t) \parallel \text{The set of candidates contained in transaction. } t$

For all candidates $c \in A_t$, do.

$c.\text{count}++$

End.

$K_l = \{c \in A_t \mid c.\text{count} \geq \text{min sup}\}$

End.

Reply = $\bigcup K_l$

The frequent first item set K_1 and frequent second item set K_2 are generated one after another until some u value occurs to make K_u empty, and the algorithm terminates. In l the cycle, a set A_l of candidate l itemset is generated, and the role of each set in A_l is to generate candidate set of frequency sets, and the generation of each set is done by connecting $(l-2)$ frequency sets with only one different item by K_{l-1} , and the final generated frequency set K_l must be some subset of A_l . It is necessary to verify each element in A_l in database to determine whether each element can be added to K_l , and it is necessary to scan the database several times during verification. Therefore, the disadvantage of the Apriori algorithm is that generation of the candidate set is too large and

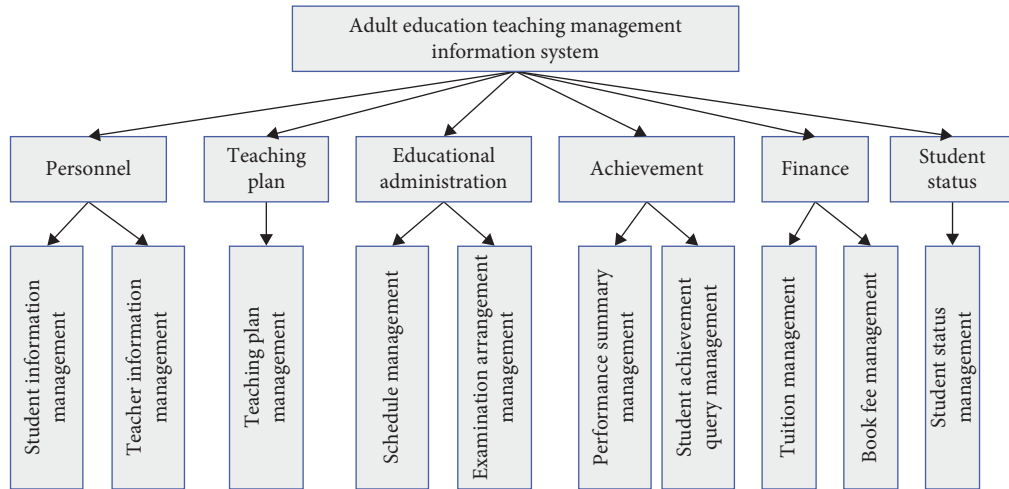


FIGURE 1: Student registration management.

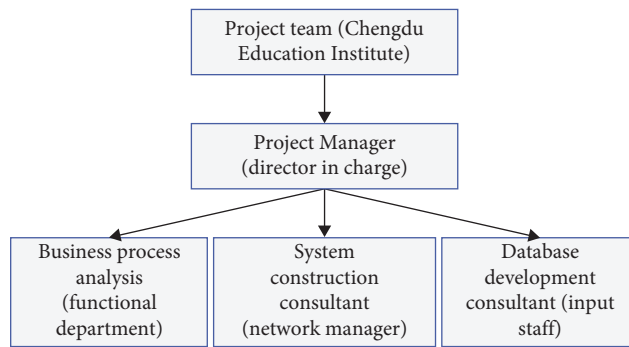


FIGURE 2: Organizational structure of teaching management informatization project.

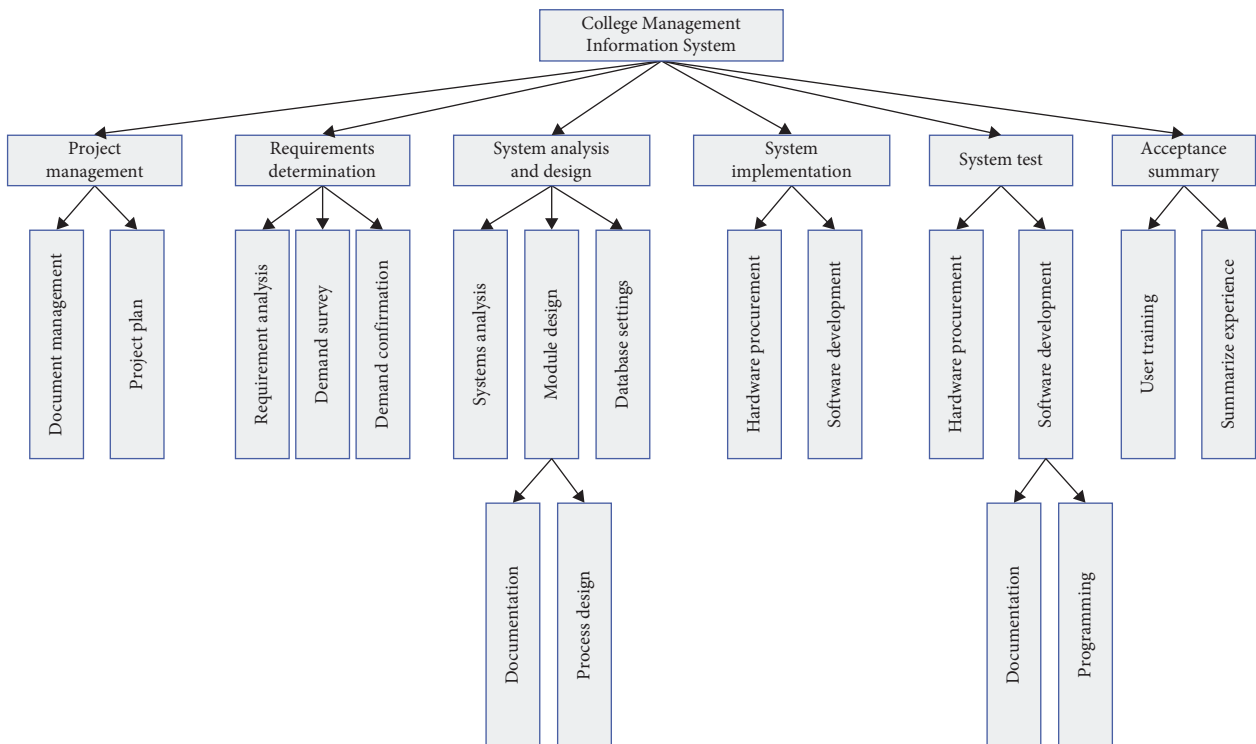


FIGURE 3: Structure decomposition of teaching management information system.

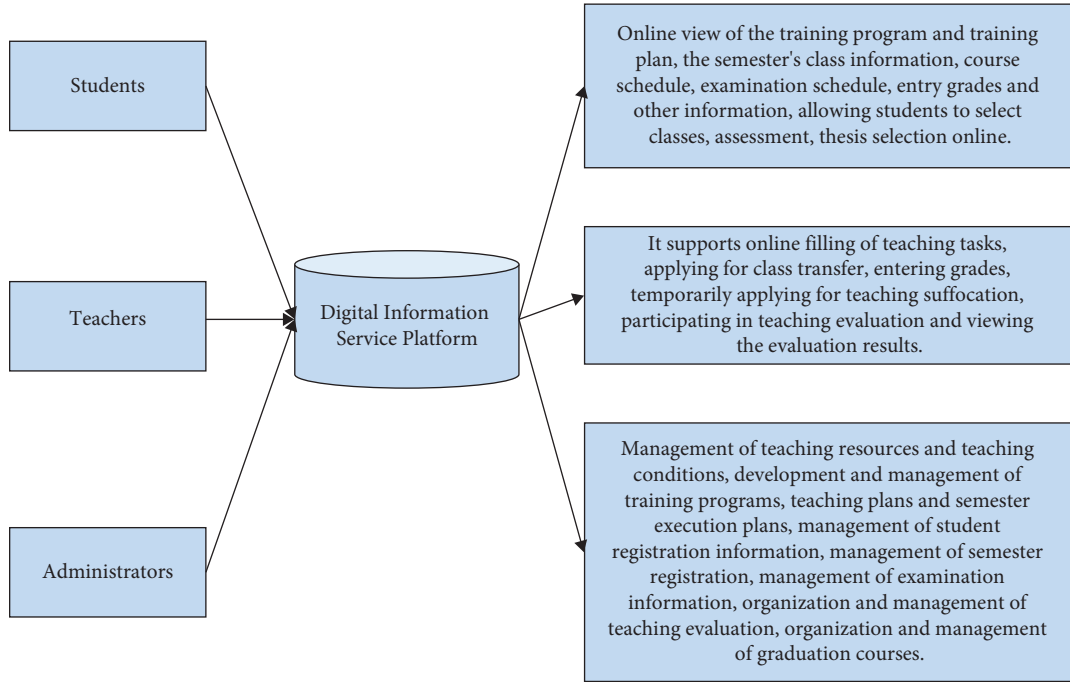


FIGURE 4: Functions and services of X College digital information service platform.

the scanning time is too long due to repeatedly scanning database, which is the bottleneck of the Apriori algorithm.

To improve the Apriori algorithm and enhance its efficiency, the pruning technique is added to the algorithm to reduce the size of candidate set A_l volume. The pruning technique is added to an algorithm based on the property that an item set belongs to a frequency set and all its subsets are frequency sets, and if there is a $(l-2)$ subset of a candidate item set in A_l that does not belong to a frequency set (K_{l-1}), this candidate set can be pruned out.

The association rules on basis of constraints are obtained based on the improved Apriori algorithm.

Definition 1. Let set of n different items be $J = \{j_1, j_2, \dots, j_n\}$, and set of management for J be B . Each management includes several items j_1, j_2, \dots, j_l , and the association rule can be expressed as

$$E \cap Q_e \Rightarrow F \cap Q_f, \quad (1)$$

where Q_e and Q_f both denote constraints; E and F denote item sets, $E \subset J, F \subset J$, while $E \cap F = \mu$, μ denotes the existence of constraint associations for E and F when management includes both E item set that meets Q_e constraint and F item set that meets Q_f constraint.

Definition 2. Let management set B contains above constraint association rules, then the support of E item set under constraint Q_e $\text{Support}(E)$ is

$$\text{Support}(E) = \frac{\text{Support} - \text{count}(E)}{m}, \quad (2)$$

where M and $\text{Support} - \text{count}(E)$ denote the number of data (total number of matters) and E number of times item

set appears in management, respectively. Within the management set B there are $b\%$ of management, including both E with Q_e constraints and F with Q_f constraints.

In terms of credibility, if $E \subset J, F \subset J$, while $E \cap F = \mu$, then the credibility of $(E \Rightarrow F)$ can be defined as

$$\text{confidence}(E \Rightarrow F) = \frac{\text{Support} - \text{count}(E \cup F)}{\text{Support} - \text{count}(E)}, \quad (3)$$

where $\text{Support} - \text{count}(E \cup F)$ denotes number of occurrences of E, F itemsets together in management. Within managed set B , there exists $a\%$ of F itemsets with both Q_f constraints within E itemsets with Q_e constraints.

In privacy protection of outsourced association rule mining, data owner requires cloud server to be able to compare support and confidence with read values. However, support and confidence must be kept confidential to cloud server and data owner, and comparison results must also be kept confidential to the cloud server.

In the Paillier encryption system, for all plaintexts m_1 and m_2 any random number used for encryption can be transformed into following equation, where modulo inverse $E(m_2)^{-1}$ is calculated by n^2 .

$$(m_1 + m_2 \bmod n) = D(E(m_1) \cdot E(m_2) \bmod n^2). \quad (4)$$

And

$$(m_1 - m_2 \bmod n) = D(E(m_1) \cdot E(m_2)^{-1} \bmod n^2). \quad (5)$$

If (m_1, m_2) satisfies $0 \leq m_2 \leq m_1 \leq n \leq 2$, then

$$\begin{aligned} m_1 + m_2 &= D(E(m_1) \cdot E(m_2) \bmod n^2), \\ m_1 - m_2 &= D(E(m_1) \cdot E(m_2)^{-1} \bmod n^2). \end{aligned} \quad (6)$$

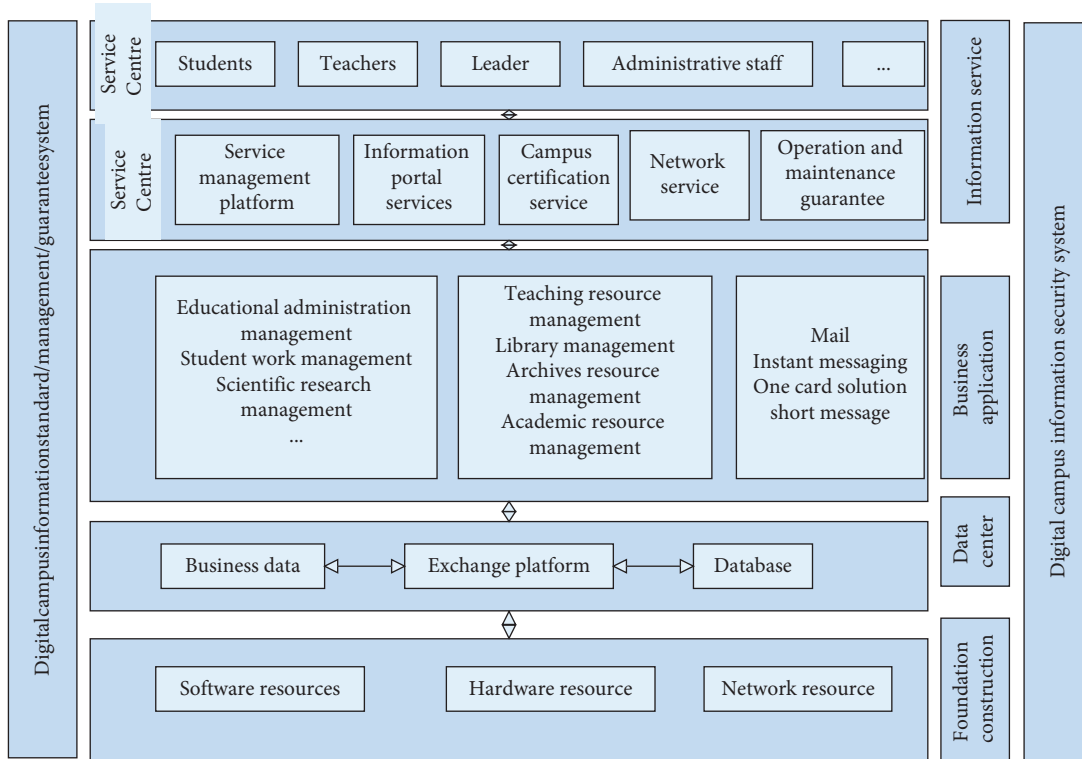


FIGURE 5: Framework system of the digital information service platform of X-college.

When sign of $m_1 - m_2$ is unknown, the Paillier cipher system can be improved. The encryption remains same, when m is negative, we can calculate $E(m)$ as $E(m \bmod n)$. decryption is modified to $D'(c) = [D(c)]_n$, defining $[x]_n = ((D(c) + \lfloor n/2 \rfloor) \bmod n) - \lfloor n/2 \rfloor$. if $-(n/2)m(n/2)$, then $D'(E(m)) = m$.

$$[m_1 + m_2]_n = D'(E(m_1) \cdot E(m_2) \bmod n^2). \quad (7)$$

And

$$[m_1 - m_2]_n = D'(E(m_1) \cdot E(m_2)^{-1} \bmod n^2). \quad (8)$$

If $-(n/4)m_1(n/4), -(n/4)m_2(n/4)$ is satisfied, then we can get:

$$m_1 + m_2 = D'(E(m_1) \cdot E(m_2) \bmod n^2). \quad (9)$$

And

$$m_1 - m_2 = D'(E(m_1) \cdot E(m_2)^{-1} \bmod n^2). \quad (10)$$

5. Results

A total of 569 student questionnaires were distributed and 569 were recovered, with a recovery rate of 100%. There were 569 valid questionnaires and 0 invalid questionnaires. It preliminarily meets the survey and design requirements.

Figure 6 shows the frequency of using devices in teaching of 73 teachers surveyed, from 1 indicating none to 5, indicating that the frequency of use is very often. From the above figure, it can be seen that teachers use information

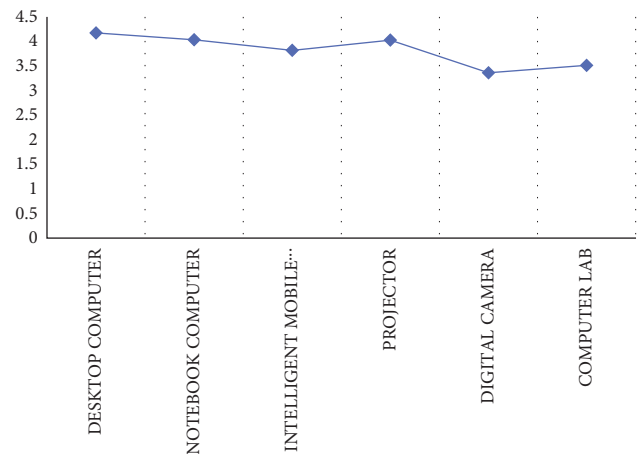


FIGURE 6: Survey on frequency of teachers' use of equipment in teaching.

technology equipment very frequently, basically above 3.5 points. However, the frequency of using interactive whiteboards, digital cameras and video cameras, computer labs, and speech rooms is less than 3.5. This means that teachers are not very proficient in using the latest information technology teaching equipment, and the school's training in this area is not very effective. Moreover, the frequency of using computer labs and speech rooms is not high, which also indicates that in the process of implementing information technology teaching, many times it is only for competition, not really for teaching reform, and reform is just a formality.

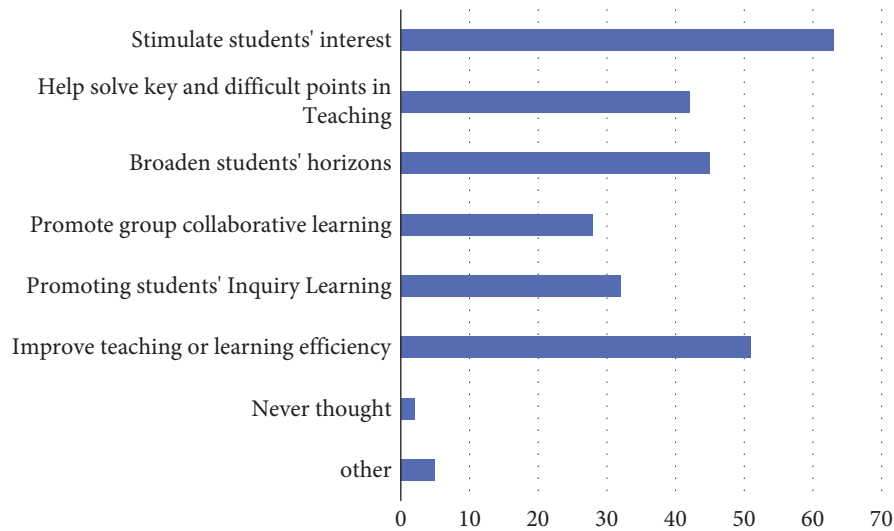


FIGURE 7: Survey of teachers' choice of using information technology for teaching purposes.

Figure 7 is a multiple-choice question that investigates the purpose of using information technology for teaching and learning among 73 teachers. The number of teachers was calculated according to the number of teachers. According to survey results, teachers' purpose of using information technology is mainly focused on "stimulating students' interests and improving students' attention." 63 people (86.3%) agreed with this view, and 50 people (68.49%) agreed with the view of "improving teaching or learning efficiency." Fifty people, or 68.49%, agreed with this view. However, in the process of implementing information technology teaching, the number of people who thought it could "promote students' inquiry learning" and "promote collaborative group learning" was less than 35 people, indicating that teachers did not consider "cooperative learning" and "collaborative learning" when implementing information technology teaching. This means that teachers do not take into account theories of "cooperative learning" and "inquiry learning" when implementing information technology teaching, so the effect of information technology teaching will be reduced and the quality of students' information technology learning will not be guaranteed.

Figure 8 shows a survey of 73 teachers' opinions on the use of information technology in classroom teaching and learning, which is a multiple-choice question. Among them, 65 (89.04%) were in favor of "effective motivation for students to learn." However, it can be seen from the survey that only 30 people (41.10%) agreed that "students have a greater sense of achievement in learning," only 24 people (32.88%) agreed that "students can remember what they have learned more easily," and only 24 people (32.88%) agreed that "students have a greater sense of achievement in learning." Only 22 people (30.14%) agreed with "developing students' horizontal skills (learning to learn, social skills, etc.)," and only 23 people (31.51%) agreed with "promoting cooperation among students". Only 25 people (34.25%) agreed with "changing students' learning styles."

Figure 9 shows a survey of 569 students who learned knowledge through the Internet. This shows that students

are aware of information-based learning, but teachers and schools need to develop and encourage students to learn through information-based means, and to ensure that they do so.

Figure 10 shows a survey of 569 students on the use of school learning spaces and online platforms after school hours. The survey results show that 71% of students (404) said they had used learning spaces and online platforms, but 29% of students (165) said they had not used learning spaces and online platforms. This shows that nearly 1/3 of students did not consider using the school's learning space and online platform, which means that the usage rate is not high, indicating that students' learning habits and methods are not really computerized. Teachers do not emphasize or develop these platforms to use them for real teaching and learning. At a school management level, there is no reasonable information technology team and no information technology platform to motivate students to use learning spaces and network platforms for learning.

Figure 11 shows a survey of 569 students' perceptions of whether online information learning is helpful to them. The survey data shows that 90.69% of students, i.e., 516 students, think it is helpful, but 9.31% of students think it is not helpful, which means that teachers and school administration do not provide guidance and education on how online information can help students learn, and students are confused about how to do online learning.

Figure 12 shows a survey of 569 students about the installation of learning software on their cell phones. The survey shows that 83.66% of students, or 476 students, have installed learning software, but 16.34% of students still have not installed learning software. The installation of learning software facilitates teaching, learning, feedback, and answering questions in many ways. The fact that students do not install them means that teachers and school administrators do not have a policy or guidance for students to effectively use information technology for learning. Therefore, I believe that at the school management level and at the level of student education, measures should be taken to allow

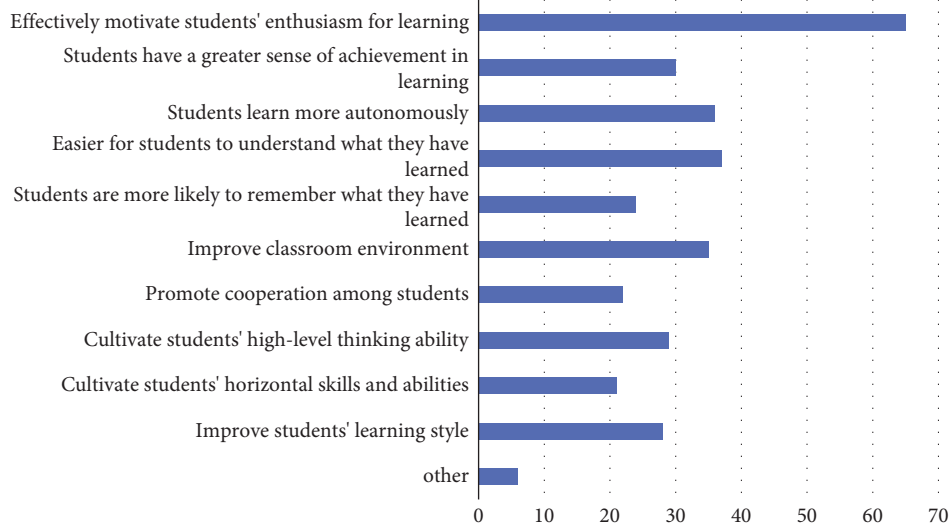


FIGURE 8: Survey of teachers' perceptions of positive impact of using information technology.

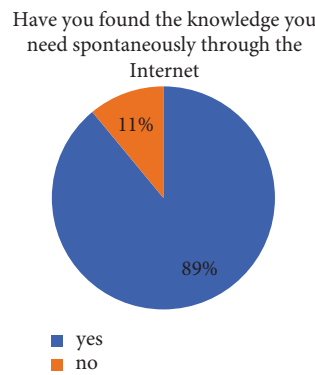


FIGURE 9: Survey on students' search for learning knowledge through online channels.

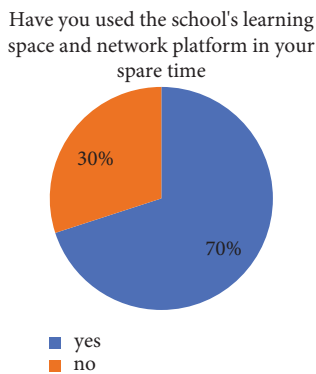


FIGURE 10: Survey on students' learning spaces and online platforms after school hours.

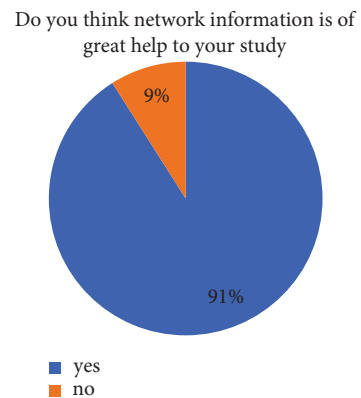


FIGURE 11: Survey of students' opinions on whether online information learning is helpful.

students to use all information technology tools to learn, rather than all information technology tools just for competition.

Figure 13 shows a survey of 569 students on online learning to get answers. The survey results show that 86.12%, or 490 students, will use online learning to get answers to classroom questions, but 13.88% of students will not use

online learning to get answers. This means that students' ability to learn information technology has not improved with the development of time and requirements of information technology, so school management should induce students to use information technology to answer questions and find answers to questions rather than in studies without direction.

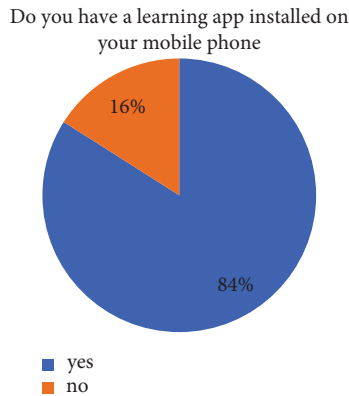


FIGURE 12: Survey on apps installed on students' cell phones for learning.

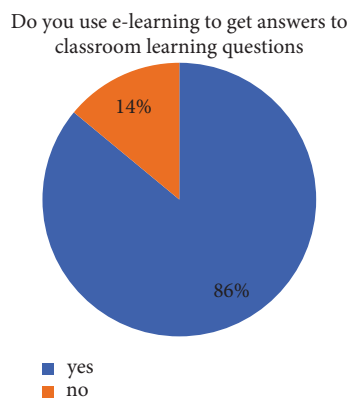


FIGURE 13: Survey of students' access to answers for online learning.

6. Conclusion

Management informatization, as an effective means to deepen management reform and improve the governance ability of universities, brings opportunities and challenges for the high-quality development of universities. However, we clearly realize that there are still many constraints that need to be solved. Management informatization in higher education is a long and complicated systematic construction project, which requires continuous research and exploration. Based on the theories of university management informatization, new public management, and digital governance, this paper starts from the current situation of universities, identifies the problems that restrict their development, then analyzes the cause-effect relationship of those problems, and finally proposes the solution countermeasures, which provides a case worthy of reference and discussion for the development of university management informatization.

This paper mainly forms the following conclusions for the promotion of the management informatization process in colleges and universities:

- (1) Management informatization should strengthen the top-level design. Management informatization faces many serious challenges in colleges and universities, such as systemic, sustainability, and complexity, and must be planned for the overall situation and in the

long term in order to continuously promote healthy and sustainable development.

- (2) Management informatization needs users' participation in construction. Only by understanding the needs of teachers and students and strengthening multiparty public governance can we grasp the direction of system construction and development and realize the modernization of university governance capacity.
- (3) Managers should establish the awareness of management informatization and service consciousness, break the thought of "emphasizing technology but not management," fine management, and active service, and realize the "one network for all" of university education management system by building a one-stop service hall.
- (4) To establish a supervision and evaluation mechanism with the participation of many parties and common construction and governance, as well as an evaluation index system for the development of management informatization. Relying on the "Internet + Supervision" system, it can realize the transformation from manual supervision to intelligent real-time supervision; build a user-centered user evaluation and feedback mechanism; and explore the normalization, real-time, and data-based evaluation and feedback.
- (5) Strengthen the construction of the management informatization team to create a composite professional team with strong innovation consciousness, a reasonable age and title structure, and a balance of business and technology. Attract more management informatization talents by establishing and improving a salary system that adapts to the characteristics of management informatization. Innovate the mode of using talents, implement a combined full-time and part-time model, and then attract more social participation in management by purchasing services and other forms. Establish a perfect evaluation and training system, target management informatization training work, and improve management informatization awareness.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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