Establishment of Teaching Diagnosis and Improvement System Based on Big Data

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Abstract-**The development of the education industry has been greatly boosted by the age of Big Data. Big Data with a large amount of information operation has been proposed and applied in the teaching of higher vocational colleges, which is both an opportunity and a challenge for teaching diagnosis and improvement of higher vocational colleges. To improve the quality of teaching and talent cultivation, Beijing Polytechnic established a big data-based teaching diagnosis and improvement system, extracted data from the school information system and diagnosed and analyzed the data on five levels, i.e., levels of the college, the major, the curriculum, the teaching staff, and the students. At the same time, a complete education mechanism and guarantee sub-sytem was set up to ensure the school-level and relevant departments handle the problems properly and promptly. Now, the system has been working for 2 years and and has achieved remarkable results.**

Keywords-Big Data; Teaching Diagnosis and Improvement; Five Horizontal and Five Vertical Strategies

I. INTRODUCTION

The core of the teaching diagnosis and improvement system based on big data is the extraction of the data from the school information system, which formed big data on five levels, i.e., levels of the college, the major, the curriculum, the teaching staff, and the student for diagnosis and analysis. According to the college-running philosophy and orientation, and talent cultivation objectives, the college identifies the shortcomings to improve the operation based on factors of talent cultivation effort such as the settings and conditions for a major, teaching staff and their capabilities, curriculum system and reformation, classroom teaching and practice, school management and system, cooperation and innovation between colleges and enterprises, and quality monitoring and effectiveness. The establishment of a teaching diagnosis and improvement system based on big data can effectively solve the pain points of education management and improve the modernization level of the education. In addition, identifying problems through teaching diagnosis and correcting problems in education and teaching work in a timely manner is more in line with the direction of teaching reformation and development under the new situation. In the long run, teaching diagnosis and improvement based on big data is an effective carrier to promote the social function of higher vocational education, and also a measure of the continuous improvement of the education level.

II. PROBLEMS

The continuous development of informatization has prompted the educational big data. However, in practice, there are still problems such as insufficient degree of modernization of management in higher vocational colleges. The practical problems in the college development are analyzed from the perspectives of teaching management, teaching staff, and comprehensive decision-making.

A. Insufficient degree of modernization of the teaching management

Teaching and learning are the lifeline of a college's survival, and teachers and students as the two important carriers of education connect almost all activities in the college. The resultant data accumulated during the teaching process is one of the important sources of educational big data, where the data set is established through a series of teaching activities, such as classroom learning, evaluation, interaction, and online teaching. The procedural data in teaching activities has a consistent role throughout the entire establishment process, starting from data generation, output, and information display, to knowledge decision-making. Meanwhile, the big data of classroom teaching cannot be captured by the conventional teaching inspection and other means in real time. Therefore, the lack of methods to quickly and accurately analyze classroom teaching quality and students learning effect results in the insufficient degree of modernization of the teaching management.

B. Inadequate capabilities of teaching staff

Teaching staff is a key issue related to the development of the education in a college. It is necessary to establish a system and mechanism, form an evaluation for teaching staff of all majors to assess their comprehensive quality

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level, and simulate the teaching staff's motivation to further improve their professional knowledge. However, conventional means and methods are not beneficial for teachers to think about deep-seated problems, such as the purpose of education and the development of their students. This cannot meet the demands of teachers for development and learning, and cannot adapt to the pace of educational growth, thereby resulting in inadequate capabilities of teaching staff in the school.

C. *Insufficient scientific comprehensive decision-making*

The comprehensive decision-making of a college requires in-depth understanding of basic data, preparation for the improvement of inadequate parts, and sensitivity towards the trends of the policy. In the context of incomplete basic data, isolated data islands, low data quality, and lack of data service system in the school, it will be impossible to make scientific decisions that are important for the survival of the school, such as enrollment plan, teaching staff development and talent policy, development of scientific research and faculty, and teaching evaluation and talent cultivation method. Without the support of big data, it would be impossible to realize the smart conversion from factual data to evaluation indicators and promptly or effectively predict the trend, resulting in insufficient scientific comprehensive decision-making in the college.

III. SOLUTION DESIGN

A. *Establish a teaching diagnosis and improvement system as well as a quality culture for all*

Establish the working mechanism of teaching diagnosis and improvement based on big data to guide the establishment of quality culture for all teaching staff and students and ensure high quality teaching and learning process. It will also construct a networked and full-coverage teaching diagnosis and improvement system with strong early warning function and incentive effect with five horizontal and five vertical strategies to achieve the continuous improvement of college management and talent cultivation quality.

B. *Create a two-chain system and build an 8-character spiral from five aspects*

Create a target chain and a standard chain, where the key data of the college, the major, the curriculum, the teaching staff, and the student is promptly displayed through the teaching diagnosis and improvement platform based on big data. The 8-character circulation mechanism, at the major level, is dynamically adjusted to improve the teaching management level and teaching quality of higher vocational schools.

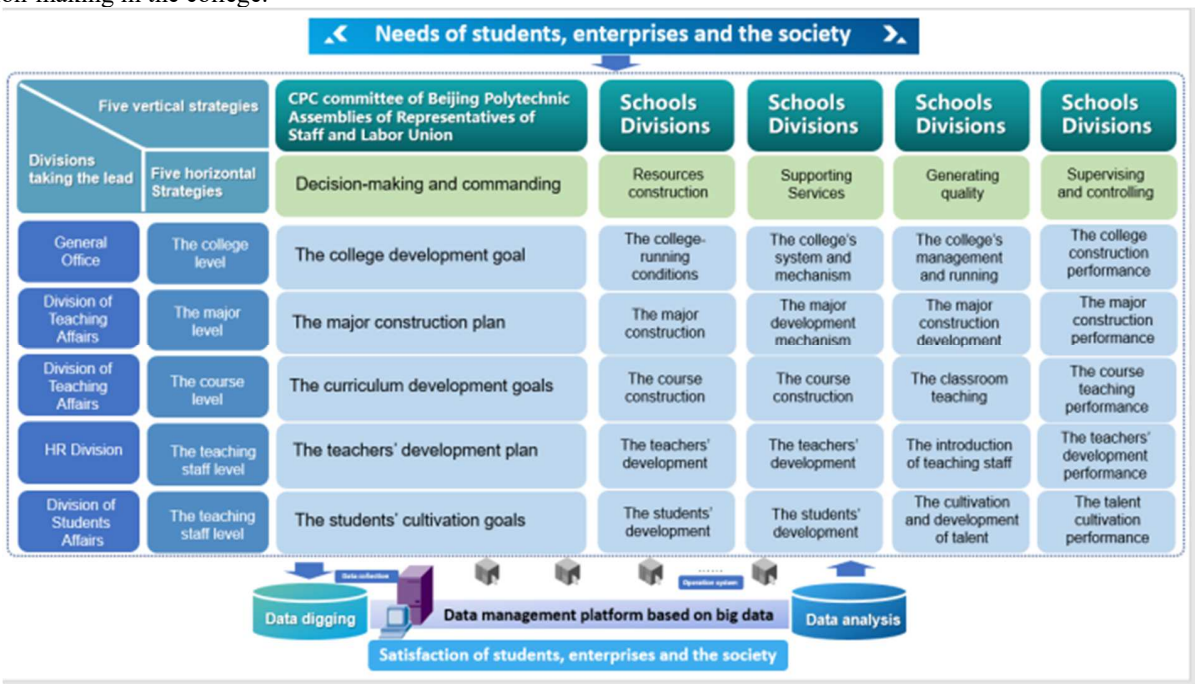

Fig.1 Framework of Teaching Diagnosis and Improvement System with Five Horizontal and Five Vertical Strategies

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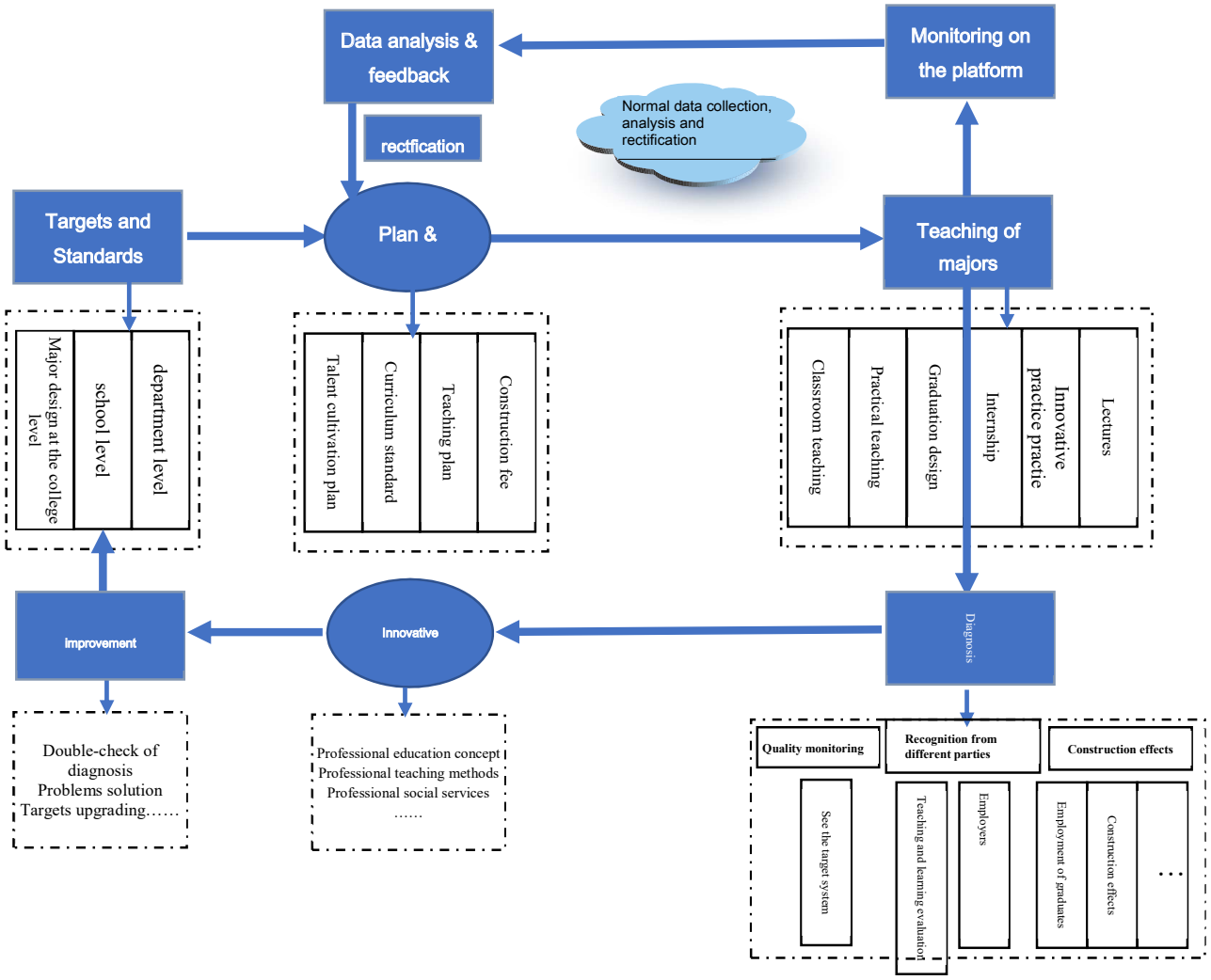

Fig.2 8-Character Circulation Diagnosis and Improvement Chart at the Major Level

C. Establish a teaching diagnosis and improvement platform based on big data

1. Teaching diagnosis and improvement platform based on big data

For the design of the diagnosis and improvement platform, the big data processing mechanism is used to realize fusion processing and calculation of multi-source heterogeneous data in the school. After regularizing and sorting data from business system, data from teaching process such as EXCEL, unstructured data such as network, and WEB applications are used as a reference to support the analysis of diagnostic indicators in the diagnosis and improvement system.

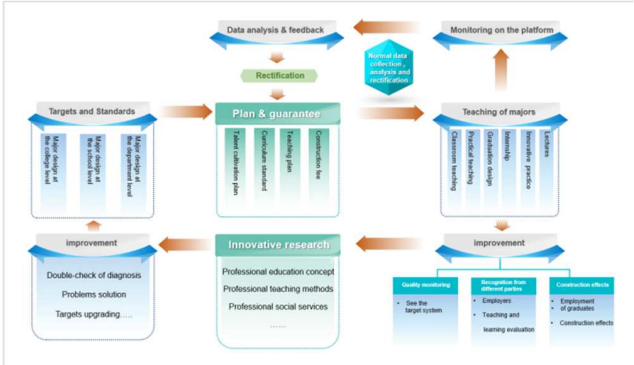

Fig.3 Teaching Diagnosis and Improvement Platform Based on Big Data

2. Smart classroom system

The purpose of smart classrooms is to establish a classroom host and information-based teaching software platform supported by the integration of software and hardware centering on teaching, and provide solutions to

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online teaching platform, classroom interactive teaching, classroom recording supervision, visual teaching data analysis, and convenient equipment control. It can also provide teaching diagnosis and improvement system with big data at the major, curriculum, teaching staff, and student levels.

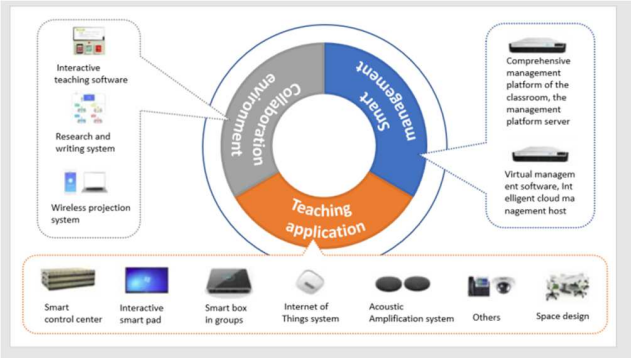

Fig.4 Smart Classroom

IV. RESULTS

A. Established normalized teaching diagnosis and improvement mechanism

A normalized teaching diagnosis and improvement mechanism is established by the college. According to the teaching diagnosis and improvement platform based on big data, data from five levels was collected, and 18 diagnosis and improvement reports were analyzed and written, including data from levels such as the college, the major, the curriculum, the teaching staff, and the student. At the college level, a detailed analysis was made on the completion of 44 key tasks in half a year to effectively promote the implementation of the work. At the major level, a detailed analysis was made on conditions including the current situation of teaching staff, the change of the number of students, and the awards of major teachers and students to effectively understand the major in detail. At the curriculum level, a detailed analysis was made on the data such as the passing rate of basic information curriculum, the passing rate of CET-3, the attendance rate of students, the digital utilization of curriculum, and the inspection of teachers or lesson plans to understand the classroom teaching situation in real time. At the teaching staff level, a detailed analysis was made on the data such as age distribution, professional titles, degree analysis, scientific research, and teaching of 37 academic leaders of the majors in the entire college to promptly and effectively understand the information of leaders of the majors. At the student level, a detailed analysis was made on the data of 35 counselors in the school, mental health education activities of college students, students' violation of discipline, and financial assistance for students with difficulties to effectively understand the information of students and student management.

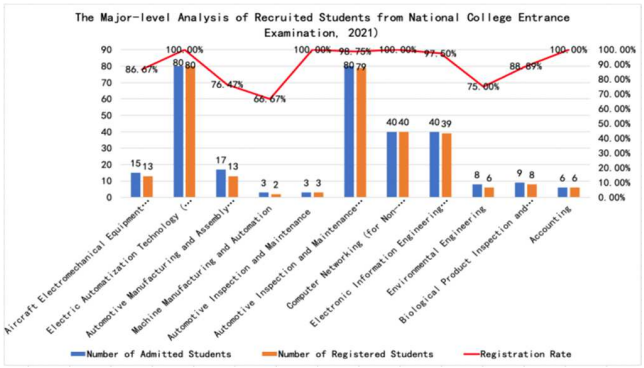

Fig.5 Analysis of the Enrollment of College Entrance Examination for All Majors in 2021

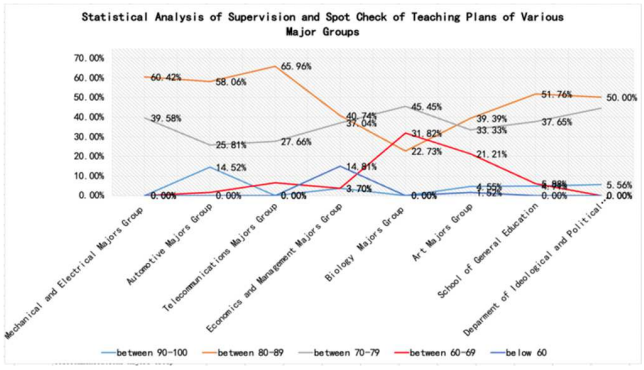

Fig.6 Statistical Analysis of Supervision and Spot Check of Teaching Plans of Various Major Groups

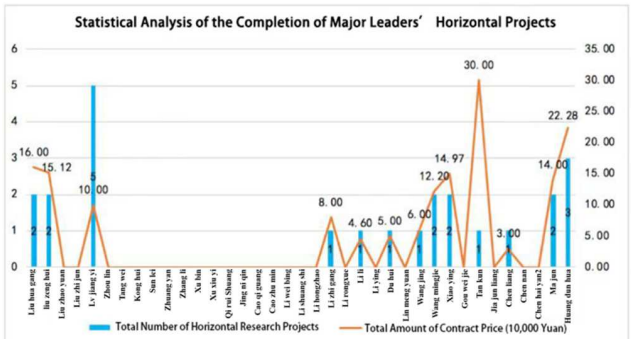

Fig.7 Statistical Analysis of the Completion of Horizontal Projects by Academic Leaders of Majors

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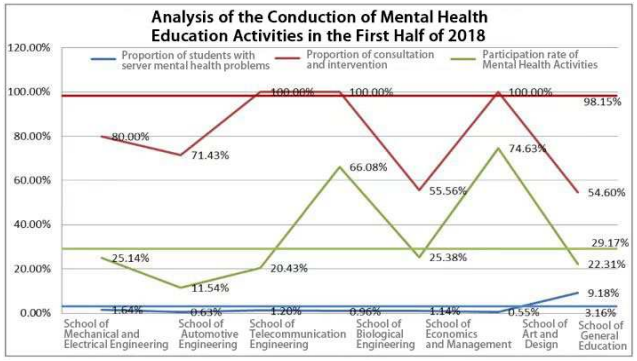

Fig.8 Analysis of the Development of Mental Health Education Activities in Schools of the College

B. Improved the modern governance capacity and level of the college

Through the top-level design, the college opened up isolated data island to construct a teaching diagnosis and improvement platform integrating the advantages of technical resources and experts based on big data, and displayed important indicators and parameters of the college development in real time. There was also an early warning to provide scientific basis for comprehensive decision-making for the college.

Fig. 9 Teaching Diagnosis and Improvement Platform Based on Big Data: A Display of the Cockpit Page

C. Improved classroom teaching quality steadily

Through the creation of a smart classroom and online course platform, dynamic teaching data were promptly collected. The collection, definition, storage, sharing, management, and analysis of the dynamic teaching data were strengthened for students' satisfaction and target completion, achieving transparency and openness of traditional teaching grey box and ensuring the accuracy and scientific nature of classroom teaching. The three-stage teaching diagnosis before, during, and after class promoted the formation of a long-term teaching diagnosis and reformation mechanism focusing on self-diagnosis and external diagnosis, boosting the steady improvement of classroom teaching quality.

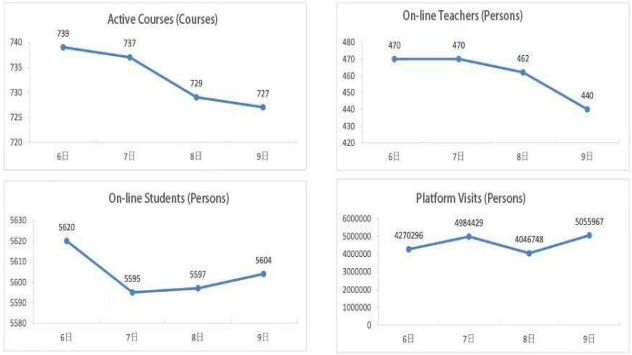

Fig.10 Real-Time Monitoring of Online Course Data

D. Strengthened capabilities of the majors and improved talent training quality

The teaching diagnosis and improvement system based on big data collected data on major teaching in real time, and strengthened projects such as new data update of major teaching system reformation and cooperation between the college and enterprise. It also promptly integrated data on state data platform, and discovered problems in improvement of the capabilities of the majors' teaching staff. Centering on student training, the analysis was initially carried out from student enrollment data in combination with the data of the cultivation process, and finally adding the data of student employment to formulate a complete path for students to grow into talents. All the data were quantitatively displayed, which greatly improved the quality of talent cultivation.

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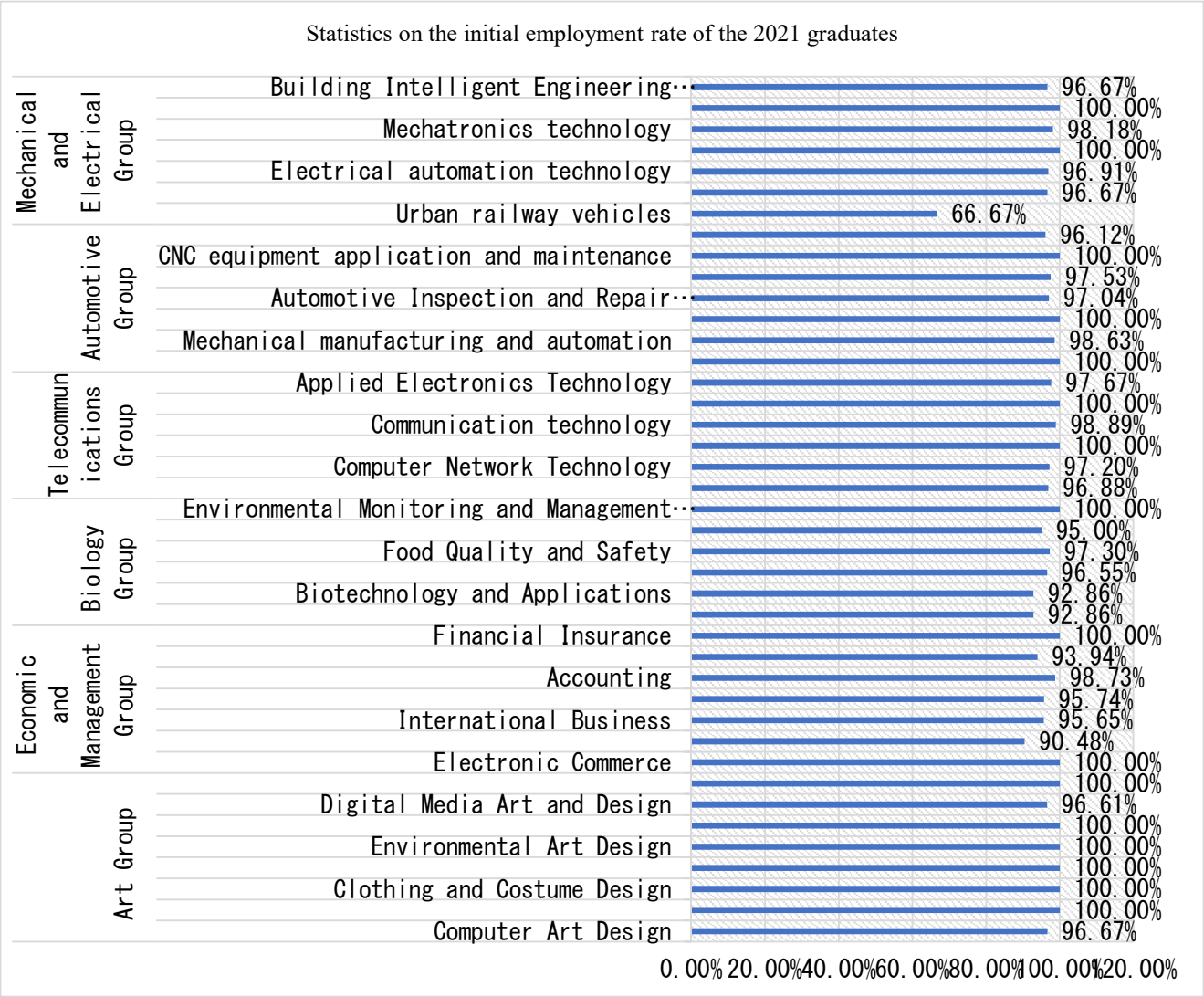

Fig.11 Statistical Analysis of Employment Rate of Students in Various Majors

V. CONCLUSION

The teaching diagnosis and improvement system based on big data established by Beijing Polytechnic extracts data from the school information system and diagnosed and analyzed the data on five levels, i.e, the college, the major, the curriculum, the teaching staff, and the students. It also has a complete education mechanism and guarantee sub-system. It has been two years since it was established and put into operation, and it has achieved remarkable results. The comprehensive improvement of the teaching quality and personnel training quality has enhanced the scientific management level of the college, providing a successful case for the development of other colleges.

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