Research on the Construction of Smart Campus in Vocational Education Based on Big Data

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Abstract. Leading the digital transformation and intelligent upgrading of vocational education with the construction of smart campuses and their modernization characteristics is becoming a hot field in the current process of educational modernization. Smart campuses have unique advantages in addressing issues such as low efficiency in traditional campus teaching management, limited learning resources, insufficient optimization of learning experiences, single educational and teaching models, low level of management informatization, and low efficiency in resource utilization. Through the specific practice of Hunan Automotive Engineering Vocational College in the construction of smart campuses, in order to provide reference and inspiration for the construction of smart campuses.

Keywords: Big data; Vocational education; Smart Campus.

1 Introduction

With the development of information technology, vocational colleges in China are gradually transitioning from traditional campuses to smart campuses. Smart campus is an advanced form of digital campus, which relies on intelligent information technologies such as cloud computing, big data, and the Internet of Things to fully integrate teaching, management, scientific research, and campus life into a smart campus environment. In the context of the Education Informatization 2.0 Action Plan, many vocational colleges have designed and constructed smart campuses, achieving certain results, and there have also been many research literature on smart campuses. As a strong country in the development of information technology, the United States first began smart construction. The CEO of IBM proposed the term "smart earth" and provided a definition. Rashmi et al. proposed a system for identifying and locating student behavior from still images extracted from closed-circuit television (CCTV) videos [1]. In their paper, Jurva et al. defined the requirements for developing a digital intelligent campus environment for data management and network infrastructure operations, in order to establish an operable 5G/IoT network for research purposes. The requirements assessment was based on ongoing actual campus network use cases [2]. Zhang Zhili et al. studied the necessity and feasibility of making the Internet of Things cover the entire

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campus through wired and wireless access, and proposed specific implementation strategies. The Chinese government attaches great importance to the construction of educational informatization, and its research results are even more outstanding[3]. Lu Xiangqun and Sun Yu conducted an overall design of the requirements and scenarios for 5G educational applications, and the overall view constructed includes teaching, research, and educational management; The innovation of application scenarios mainly includes remote teaching, VR/AR teaching, remote listening and evaluation, AI evaluation of teaching processes, and smart campus management[4]. Xu Cuiying's research points out that educational informatization needs to achieve the development and transformation from "digital campus" to "smart campus"[5]. Miao Heming and Zhang Liang studied the significance and value of the deep and comprehensive integration and innovation of information technology and space, technology and teachers, technology and curriculum, technology and teaching, and technology and evaluation. They proposed a "five in one" integration strategy, including goals, actions, diagnosis, and evaluation strategies[6].

2 Comparison between Smart Campus and Traditional Campus

2.1 The Connotation of Smart Campus

Smart campus refers to the use of advanced information technology and Internet of Things technology to integrate campus resources, improve teaching management efficiency, improve the experience of teachers and students, and achieve an efficient and intelligent campus management and service system. Its connotation includes aspects such as school informatization construction, digital teaching, intelligent campus environment, data analysis and decision support, aiming to achieve educational informatization, intelligence, and sustainable development. Through the construction of smart campuses, the level of school management can be improved, the quality of teaching can be improved, and the innovative development of education can be promoted[7].

2.2 Shortcomings of Traditional Campuses

Traditional campuses have the following shortcomings:

Low efficiency of teaching management: Traditional campus teaching management mainly relies on manual operation, with cumbersome processes and low efficiency, which can easily lead to problems in information transmission and management.

Limited learning resources: Traditional campus learning resources mainly rely on physical libraries and classrooms, and students have limited access to information and learning content, making it difficult to meet personalized learning needs.

Insufficient optimization of learning experience: The learning environment and facilities on traditional campuses are relatively rigid, which has certain limitations on students' learning experience and participation, and lacks personalized services[8].

The education and teaching mode is single: The traditional campus education and teaching mode mainly focuses on traditional face-to-face classroom teaching, lacking diversified and innovative teaching modes.

Low level of management informatization: The informatization level of traditional campuses is relatively low, and school management relies on paper documents and manual processing, which is prone to information loss or inaccuracy.

Low resource utilization efficiency: Traditional campuses suffer from resource waste and low efficiency, such as low classroom utilization and improper library resource management.

2.3 The Advantages of a Smart Campus

Compared to traditional campuses, smart campuses have the following advantages:

Improving teaching management efficiency: Smart campuses utilize information technology and data analysis methods to achieve automation and intelligence in teaching management, improving the efficiency and accuracy of teaching management.

Learning experience optimization: Smart campuses provide digital teaching resources and intelligent learning environments, creating more convenient and personalized learning experiences for teachers and students, and promoting the improvement of learning outcomes.

Innovation in Education and Teaching: Smart campuses provide more possibilities for education and teaching, supporting the implementation of new teaching models such as online teaching, distance education, and virtual experiments, and promoting innovation in education and teaching.

Resource sharing and collaborative learning: Smart campuses provide convenient resource sharing platforms and diverse collaborative learning environments, promoting interaction and knowledge exchange between teachers and students, and improving learning outcomes.

Sustainable development of education: Smart campuses focus on energy conservation, emission reduction, and resource utilization efficiency, promoting the implementation and practice of green environmental protection concepts in the field of education, and promoting sustainable development of education.

Data driven decision-making: Smart campuses provide decision support for school managers through data collection and analysis, helping schools to more accurately understand the operation of the school, and adjust and optimize management strategies in a timely manner[9].

The comparison between smart campuses and traditional campuses is shown in Table 1.

Table 1. Comparison between Smart Campus and Traditional Campus

Aspects	Traditional Campus	Smart Campus
Teaching management efficiency	Low	High
Learning resource	Limited	Rich

Learning experience	Lack of personalization	Personalized learning experience
Education and teaching mode	Single	More
Management informatization level	Low	High
Resource utilization efficiency	Low	High

3 A Case Study of Building a Smart Campus for Vocational Education Based on Big Data

Taking Hunan Automotive Engineering Vocational College as an example, the school adheres to digital empowerment and sets a new benchmark for a "one body, two wings, four layers, and six clouds" smart campus. With the construction of "Yunshang Huqi" as the starting point, we have systematically promoted the new infrastructure of smart environment, gathered more than 40 application systems such as personnel management and student growth, and built a "three visualizations and one precision" big data analysis platform. With the accompanying collection of data from the entire process of education, teaching, management services, etc., we present it through visualization technology to provide a basis for decision-making and improvement, promote all-round changes in teaching, learning, management, and evaluation, promote the improvement of information literacy and talent cultivation quality of teachers and students. We have successively established the first batch of national pilot units for the construction of digital campuses in vocational colleges, built a national benchmark school for digital campuses in vocational colleges, and won titles such as a model school for digital campus construction in vocational colleges and one of the top 50 smart campuses in Chinese vocational colleges. Relevant practices have been selected as one of the ten innovative applications of the Ministry of Education A big case, at the 2023 World Digital Education Conference, Minister Huai Jinpeng of the Ministry of Education affirmed that the "three visualizations and one precision" education and teaching management model has been included in the "Opinions of the Hunan Provincial People's Government of the Ministry of Education on Promoting the Modernization of Vocational Education and Serving the" Three Highs and Four News "Strategy throughout the Province.

Firstly, coordinate and design the overall framework to support digital upgrading. The school has advanced the development of a digital campus construction plan, as a sub plan of the school's 14th Five Year Plan, and designed an overall framework of "one body, two wings, four layers, and six clouds". With the goal of serving the education, teaching, and daily life of teachers and students as the "one", and with the "standard specification system" and "security guarantee system" as the "two wings" to escort, a "six cloud" platform consisting of "management cloud" and "service cloud" is constructed according to the "four layer" architecture of "foundation support application cloud". Efforts are made to break down information silos, break through data barriers, break through application system functional barriers, and achieve learning everywhere and everyone, with more data running and fewer teachers and students running errands[10].As shown in Figure 1.

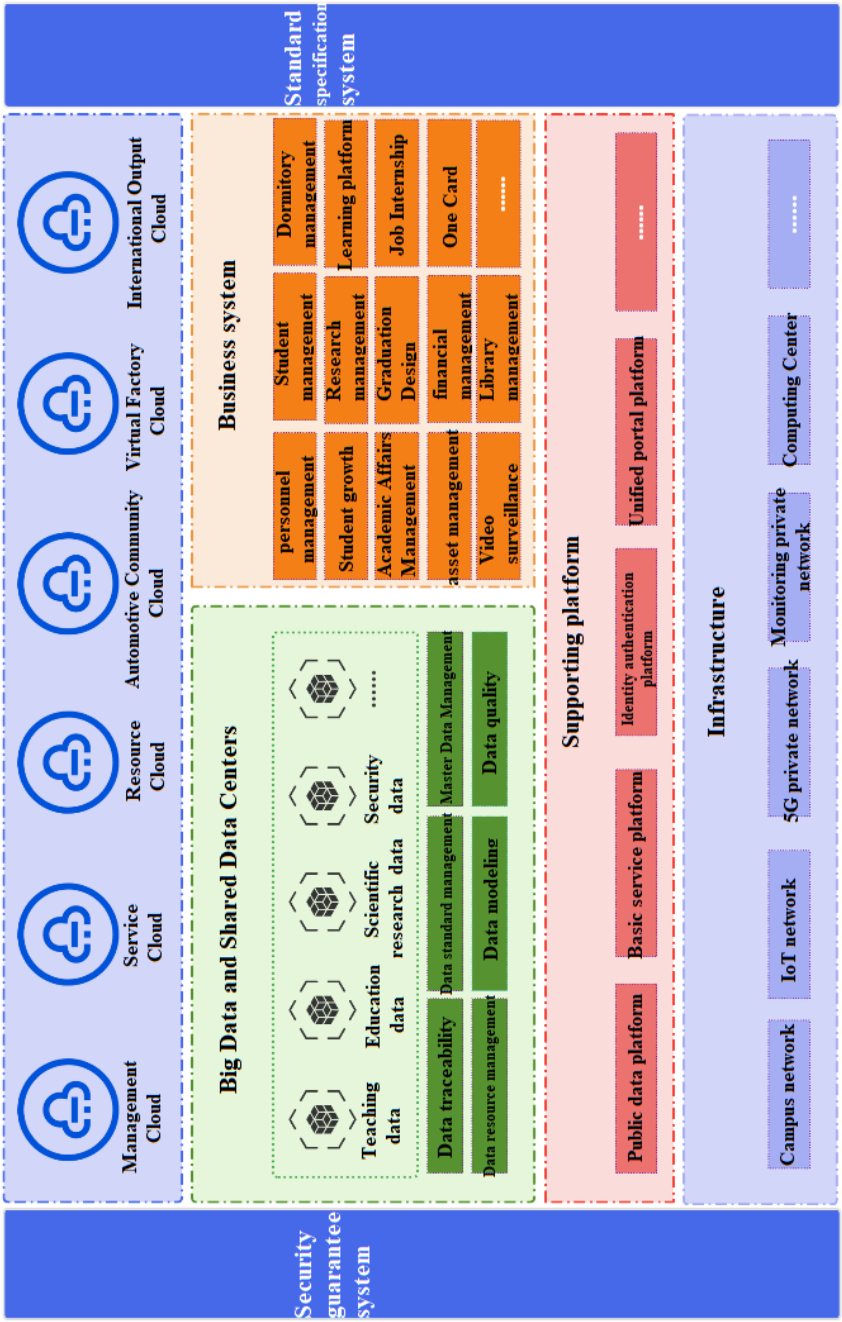

Fig. 1. Overall Structure of Smart Campus

Secondly, building new infrastructure and creating an intelligent environment. All areas of the school are connected to the 5G public network, and a campus fiber optic network with a capacity of 10 Gigabit to buildings and 1000 Gigabit to desktops has been constructed; We have built a school level resource platform that gathers data from multiple platforms such as WeChat Knowledge Base and Chaoxing, achieving one-stop login, cross platform access, and multi-level platform interconnection; We have gathered teaching resources such as 3 national teaching resource libraries, 4 provincial resource libraries, and 51 provincial high-quality online courses, and built a knowledge map for core professional courses such as an automotive digital museum and "Artificial Intelligence Technology"; We have built and upgraded 327 smart classrooms and training venues, deployed over 500 sets of smart teaching equipment, established a campus public safety monitoring system, completed network security level protection records for 8 application systems such as academic management system and big data analysis, and supported the construction of a safe campus[11].

Thirdly, promote smart applications and carry out digital transformation. The school insists on using digitalization to lead the modernization of the school, creating three types of "smart classroom" scenarios: scenario based, community based, and appointment based, as well as three types of digital training modes: "C+R", VR virtual simulation training, and teacher-student "synchronous training", effectively solving the "three highs and three difficulties" problem in vocational education student internship training; We have built an intelligent education data management platform, which analyzes big data based on teaching and learning situations using AI, and forms quality analysis reports on classroom teaching effectiveness from six dimensions. We have also opened up a "remote course inspection" module to achieve remote supervision, online evaluation, and sharing of excellent classroom experience, assisting teachers in teaching research and reform; Built an internal control system to dynamically monitor key tasks, important work, and daily operational data of the school, accurately grasping core information such as progress and funding; Build a self-service hall, complete the construction of six functional areas including student management, teaching management, and life services, and the stock data of the school data center exceeds 70TB.

Fourthly, build a big data analysis platform and implement precise decision-making. The school has established a big data sharing center and carried out big data analysis applications marked by "three visualizations and one precision". It has built 2428 business data tables and 32156 data fields, collected process data from teaching platforms, as well as behavior data from teachers and students in three service centers, including personalized portals, online service halls, and self-service terminals. The data has increased by over 100000 pieces per day; Establish an evaluation model for educational level based on dimensions such as school conditions, educational capabilities, educational effectiveness, competitiveness, and scientific governance level. Construct a teacher development evaluation model based on dimensions such as teacher ethics, teaching style, educational research, social services, and social recognition, using the "5 dimensions, 5 layers, and 11 levels" method. Construct a student growth evaluation model that integrates commonality, differences, and individuality around morality, intelligence, physical fitness, beauty, and labor, integrate more than 40 business systems,

optimize and reconstruct 86 business processes, and build a precise model for management services; We have established a graphic library that includes more than 20 categories such as bar charts, pie charts, line charts, radar charts, etc. Through big data analysis, the analysis results are visualized and targeted to data users. We intelligently analyze the behavior of teachers and students, accurately handle abnormal data, and make decisions more accurate [12].

4 Conclusions

Smart campuses emphasize the concept of "service as the core, management as the support", and comprehensively utilize emerging technologies such as 5G, big data, and artificial intelligence to build an intelligent perception environment and a new type of education and teaching space that integrates virtual and real. They provide personalized and innovative services that are people-oriented and intelligent and open to teachers and students, realizing the integration and innovation of information technology with teaching, teaching and research, scientific research, management, and services, and forming a new campus ecology that is "perceptible, diagnosable, analyzable, and elastic". However, under the influence of the development of the Internet and in the process of building smart campuses, many vocational colleges will face problems and challenges such as information islands, hidden dangers of information security, repeated construction and high cost maintenance, and the acquired shortage of systems. School administrators, educators and campus builders need to jointly see the current situation of their own smart campus construction, deeply analyze the shortcomings and difficulties of smart campus development, and seriously explore the future trend and development direction of "Internet plus smart campus".

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