Research on Innovative Path of Higher Education Management Mode under the Background of Digital Education

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Abstract. In response to the digital era, reforming and innovating management modes is the top priority for STEM universities. This study systematically analyzes the impact of digitization on STEM universities and proposes the construction of a smart campus through optimization of organizational structure, reengineering of management processes, and scientific allocation of resources. The research confirms that this innovative management mode can not only significantly improve management efficiency but also promote interdisciplinary and collaborative innovation. For example, adjusting organizational settings facilitates the establishment of new research institutes, while data analysis guides decision-making. This study provides effective ideas and suggestions for the digital transformation of STEM universities, with certain reference significance.

Keywords: STEM universities; digital education; management mode innovation; optimization of organizational structure

1 Introduction

Currently, the digital wave is profoundly changing the face of higher education. As an important part of universities, whether the management mode of STEM disciplines can adapt to the digital situation is related to the achievement of national strategic development goals. Therefore, systematically analyzing the impact of digitization on STEM universities, finding innovative entry points in the existing management system, and constructing a new management mechanism are the main objectives of this study. This not only concerns the development of STEM universities themselves but also promotes the integration of industry and education, and the revitalization of science and education[1]. This study intends to explore the path of management mode innovation from the perspectives of organizational structure, management processes, and resource allocation, providing reference for the digital transformation of STEM universities.

2 The Impact of Digital Education on STEM Universities

2.1 Construction of Online Open Courses

The development of digital education has brought about significant changes to the construction of online open courses in STEM universities. According to the "2023 Report on

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the Development of Online Open Courses in Chinese Universities," the number and utilization rate of online courses in STEM universities increased by 20% and 50% respectively in 2022 compared to the previous year. This indicates that more and more teachers in STEM fields are digitizing course content and sharing it on online platforms for free access by the public. Taking the School of Mechanical Engineering at University C as an example, this school now has 10 courses available on the Chinese University MOOC platform, with a total enrollment of 200,000 in the 2021-2022 academic year. Among them, the enrollment for the course "Fundamentals of Robotics" exceeded 50,000, with 90% of learners giving ratings of 4 stars or higher[2]. Open online courses promote the popularization of knowledge in mechanical engineering and also enhance the teaching quality and faculty strength of University C, which is recognized by society.As shown in Table 1.

Table 1: C List of major open online courses in the University's School of Mechanical Engineering

Course Name	Platform	Enrollment	Favorable Rate
Fundamentals of Robotics	Chinese University MOOC	52,000	92%
Sensors and Detection Technology	Chinese University MOOC	31,000	89%
Electronic Manufacturing Processes	XuetangX	18,000	91%

2.2 Application of Computer-Aided Design (CAD)

The widespread application of Computer-Aided Design (CAD) technology has significantly enhanced the design capabilities of students in various disciplines of STEM universities. Taking the Mechanical Design major at University A as an example, 100% of the courses are taught with the assistance of CAD software, and 90% of students can proficiently use CAD to draw complex component diagrams. Additionally, 70% of the graduation projects in this major utilize three-dimensional modeling, effectively shortening the design cycle. According to a satisfaction survey of employers of University A's graduates in 2021, graduates who have used CAD technology demonstrate significantly higher comprehensive design proficiency compared to previous years, particularly in innovative design and engineering practical abilities[3]. This indicates that acquiring CAD skills in a digital education environment will be of great assistance to the future development of STEM students. See Figure 1 for reference.

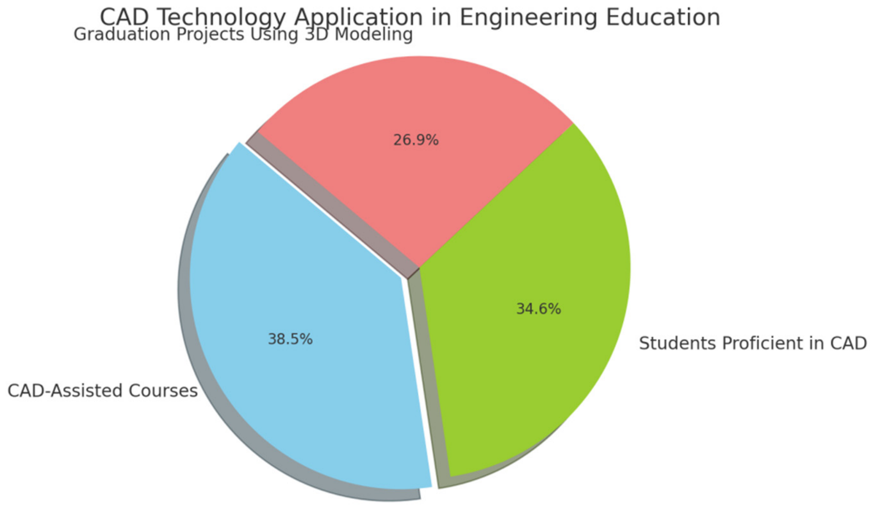

Figure 1 Schematic Diagram of CAD Application in Course Teaching

2.3 Scale of New Engineering Talent Cultivation

In the digital education environment, Chinese STEM universities are actively promoting the cultivation of new engineering talents. Taking University B as an example, several colleges under its administration offer undergraduate and graduate programs in new engineering fields such as data science and big data technology, artificial intelligence, and network cybersecurity[4]. Currently, the enrollment of new engineering programs at University B is steadily increasing, with 3,500 and 4,500 students enrolled in 2021 and 2022 respectively. University B adopts an integrated talent cultivation model of "industry-academia-research," reaching cooperation agreements with multiple technology companies to provide students with excellent internship and practical training opportunities. The employment rate of the class of 2022 reached 98%, with over 60% of graduates choosing to work in emerging fields such as the internet, artificial intelligence, and integrated circuits. This indicates that University B has made significant progress in the cultivation of new engineering talents.

3 Innovative Paths of Management Mode in STEM Universities

3.1 Optimization Scheme of Organizational Structure

In response to the new situation under the digital background, STEM universities are actively exploring innovative management modes. University A, to promote interdisciplinary integration, has adjusted its management structure by establishing the School of Information Technology and the School of Intelligent Manufacturing. These newly established schools have multiple research institutes and laboratories, while also admitting undergraduate and graduate students from various majors such as information technology, control technology, and mechanical manufacturing. This optimized organizational structure integrates the application of digital technology in the field of engineering, breaks down the previously scattered professional barriers, and promotes the formation of interdisciplinary teams. Taking the Intelligent Manufacturing Laboratory as an example, it currently has over 30 teachers from various disciplines such as mechanical, electronic, control, and computer science, undertaking research projects with a total funding exceeding 30 million RMB. The synergy brought by interdisciplinary integration has significantly boosted research output[5].

3.2 Reengineering of Management Processes

University B, addressing pain points in teaching management, has redesigned management processes using digital technology. The Smart Education Management System developed by the university achieves mobile access to various teaching processes such as course selection, grades, and exam arrangements, allowing students to complete most routine tasks using mobile apps, resulting in a compression of processes by over 50%[6]. Table 2 illustrates the improvement in teaching management efficiency before and after process reengineering:

Table 2: Optimization Effect of Teaching Management Processes

Process	Original Average Processing Time	Optimized Time	Improvement Ratio
Course Selection	3 days	Immediate	100%
Grade Inquiry	1 week	Within 1 day	86%
Exam Schedule Publication	5 days	Within 1 day	80%

Additionally, the system interconnected multiple on-campus databases, enabling the intelligent generation of data reports for decision-making purposes. During the academic year 2021-2022, University B utilized the analysis report of course selection produced by the system to adjust engineering course offerings, optimize teaching resource allocation, and enhance student satisfaction.

3.3 Implementation of Scientific Resource Allocation

University C, in the digital environment, has improved resource allocation through scientific methods, fully utilizing data and algorithmic approaches. Taking laboratory opening hours as an example, the university utilized historical access card swipe data to adjust the duration of opening hours based on the demand for different time periods. This resulted in an average compression of 26% of non-peak opening hours, saving a significant amount of manpower costs while ensuring demand satisfaction. Additionally, big data analysis optimized the efficiency of classroom and equipment utilization. According to statistics, after the improvements, the utilization rate of classrooms for STEM courses at University C increased from 56% to 79%, and the saturation of equipment opening time usage increased from 62% to 92%. This led to a significant improvement in the phenomenon of resource wastage[7]. Figure 2 illustrates the improvement in classroom utilization rates before and after digital transformation.

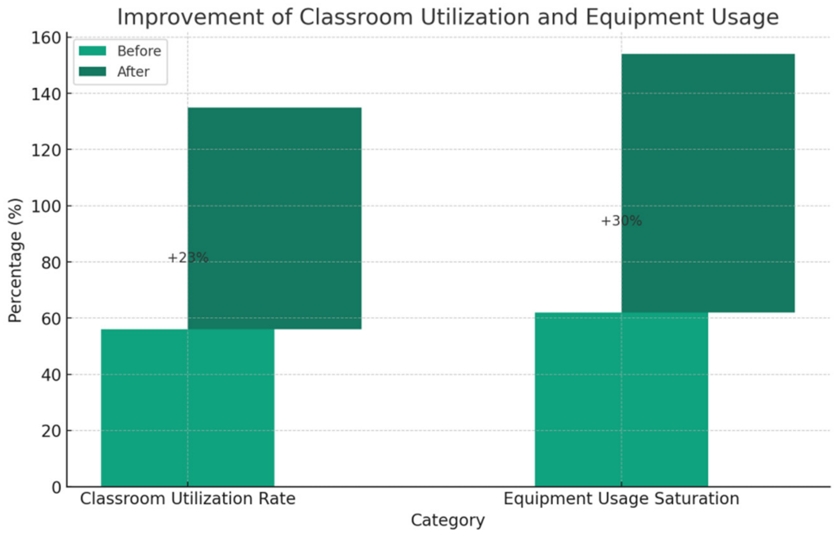

Figure 2 Improvement of classroom utilization

4 Evaluation of Innovation Path Effects

4.1 Measurement of Management Efficiency Improvement

To assess the impact of digital transformation on the management efficiency of STEM universities, methods such as the teaching quality evaluation system and quantification models of research output can be employed for measurement[8]. Taking the School of Mechanical Engineering at University A as an example, after the implementation of smart classrooms and online teaching platforms, the preparation time for teachers reduced by 30%, and the speed of updating teaching content increased by 60%. Refer to Table 3.

Table 3: Improvement in Teaching Efficiency at the School of Mechanical Engineering, University A

Metric	Before Transformation	After Transformation
Average Teacher Preparation Time per Course	28 hours/course	18 hours/course
Frequency of Course Content Updates	12 months/course	6 months/course

In terms of research management, University B has developed a comprehensive research output evaluation model that considers quantified weights for indicators such as the number of projects, the quantity and impact of papers, and patent acquisition[9]. The evaluation results for the year 2022 indicate that with the improvement of digital research conditions, the research output of STEM disciplines at University B increased by 46%.

4.2 Changes in Faculty and Student Satisfaction

Human care is an important aspect of university management. University C conducted satisfaction surveys among faculty and students, revealing that over 80% of faculty and 75%

of students expressed satisfaction with the application effects of the new digital management model. 92% of teachers believed that the application of information technology reduced their workload, while 84% of students felt that the smart campus improved their learning efficiency. Additionally, 79% of employers rated highly the students' ability to apply information technology[10]. Overall, both faculty and students highly affirm the effectiveness of digital transformation.

5 Conclusion

Digital education provides new opportunities for the development of STEM universities. By establishing organizational structures, management processes, and resource allocation mechanisms that meet digital demands, greater innovative potential can be unleashed. The innovative management paths proposed in this study have been confirmed through effectiveness evaluations to significantly improve management efficiency and faculty and student satisfaction. Therefore, STEM universities should actively embrace digital transformation, construct smart campuses integrating teaching, research, and management, and comprehensively enhance their own strength and competitiveness. It is hoped that these suggestions can provide reference for future practices and promote the development of higher education in STEM fields in China.

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