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Research on the Application of Total Quality Management in the Management of University Computer Laboratories

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Abstract: This paper aims to explore the introduction of the advanced management philosophy of Total Quality Management (TQM) into the management of university computer laboratories. By analyzing the core principles of TQM—"company-wide participation, whole-process control, and all-round management"—it constructs a laboratory quality management system focused on "students and teachers as the center" and targeting "continuous improvement."

Keywords: *Total Quality Management; Laboratory Management; Continuous Improvement; Service Quality*

I. INTRODUCTION

The management of computer laboratories in many universities faces numerous pain points[1]: outdated management concepts that focus on the "object" rather than the needs of "people"; fragmented service processes with low efficiency in equipment/software installation, fault reporting, and reservation systems; and a lack of quality evaluation, missing scientific and effective assessment and feedback mechanisms.

Total Quality Management (TQM), originating in manufacturing, is a quality-centered, organization-wide participatory approach aimed at long-term success through customer satisfaction and benefits to all members of the organization and society[2]. Its core principles—customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making, and relationship management—are equally applicable to service organizations. Introducing TQM into university computer laboratory management essentially treats the laboratory as a "service provider" and faculty/students as "customers," aiming to achieve a comprehensive improvement in service quality and optimal resource allocation through systematic process re-engineering and cultural building. This study is based on this context, exploring the integration points between TQM theory and laboratory management practice.

II. CORE PRINCIPLES OF TQM AND THEIR APPLICABILITY

A. Core Principles of TQM

TQM is not a single management method but a complete philosophical system and management framework. Its core ideas can be summarized as:

Customer Focus: The organization depends on its customers and therefore must understand current and future customer needs, meet customer requirements, and strive to exceed customer expectations. In the laboratory context, the "customers" are the teachers and students using the lab.

Engagement of People: People at all levels are the essence of an organization, and their full involvement enables their abilities to be used for the organization's benefit. Quality improvement requires the joint commitment of administrators, teachers, students, and even logistics staff.

Process Approach: Desired results are achieved more efficiently when activities and related resources are managed as a process. Laboratory management can be decomposed into processes such as equipment procurement, software deployment, daily maintenance, open access service, and fault handling.

Continuous Improvement: Continuous improvement of the overall performance should be a permanent objective of the organization. Laboratory management needs to establish a self-improvement mechanism to constantly identify opportunities for improvement.

Evidence-Based Decision Making: Effective decisions are based on the analysis of data and information. Management decisions should be based on data such as equipment utilization rate, failure rate, and user satisfaction surveys, rather than experiential intuition.

B. Applicability of TQM to Computer Laboratory Management

University computer laboratories are typical "service-technology" complex systems. Their output is "experimental service," and their "production process" includes environment preparation, resource allocation, technical support, and teaching guidance. This is highly isomorphic to the service industries where TQM is applicable. The standardization, process-orientation, data-driven approach, and continuous improvement emphasized by TQM are precisely the keys to solving current laboratory management dilemmas. By importing TQM, scattered management activities can be systematized, and passive response can be transformed into active service, ultimately achieving a fundamental change in the management model.

III. CONSTRUCTING A TQM-BASED QUALITY MANAGEMENT SYSTEM FOR UNIVERSITY COMPUTER LABORATORIES

A. System Construction Principles

Customer Orientation Principle: The starting point of system design must be to meet the needs of teaching and research. Conduct regular demand surveys and treat user feedback as the highest priority for improvement.

Systematic and Holistic Principle: Manage the personnel, machines, materials, methods, and environment (Man, Machine, Material, Method, Environment - 4M1E) of the laboratory as an integrated system to ensure synergistic operation of all links.

Prevention-Oriented Principle: Shift from "remedy after the event" to "prevention before the event," e.g., using disk protection technology and automated deployment tools to

prevent OS/software crashes, and conducting regular inspections to prevent hardware failures.

Measurability and Evaluability Principle: Establish quantifiable Key Performance Indicators (KPIs) for all critical service processes, such as software installation response time, Mean Time To Repair (MTTR), and equipment availability rate.

B. Implementation Path and Strategies

1. Demand Analysis and Quality Positioning (Plan)

First, comprehensively collect the needs and expectations of teachers and students (internal customers) regarding the lab environment, hardware performance, software versions, opening hours, and technical support through questionnaires, seminars, and interviews. Based on the survey results, define the laboratory's quality policy and objectives, e.g., "Provide an experimental environment with 99.5% availability," "Ensure mainstream teaching software is installed within 2 working days after application submission."

2. Process Management and Standardization (Do)

Sort out and standardize the core business processes of the laboratory, creating procedure documents and work instructions. Examples include:

《Standardized Process for Software Installation Request and Deployment》: Clarify each step and time limit for teacher application, departmental approval, lab reception, testing, and batch deployment.

《Hardware Fault Reporting and Handling Process》: Standardize the closed-loop process of student reporting, administrator receiving the order, diagnosis, repair, and feedback.

《Laboratory Open Booking Process》: Establish an online booking system for fair and transparent resource allocation.
Implement "5S" management (Sort, Set in order, Shine, Standardize, Sustain) to optimize the physical environment of the laboratory, improving work efficiency and safety.

3. Dynamic Monitoring and Measurement (Check)

Establish a monitoring mechanism to measure the execution effect of processes and the achievement of quality objectives. It mainly includes the following contents:

Digital Monitoring: Utilize the Laboratory Management Information System (LMIS) to automatically record equipment usage time, booking status, software access logs, etc.

Regular Checks: Check equipment availability rate weekly, and calculate average fault repair time monthly.

Satisfaction Surveys: Conduct satisfaction surveys among teachers and students at the end of each semester to collect subjective feelings and qualitative feedback.

4. Feedback and Continuous Improvement (Act)

This is the most critical part of the PDCA cycle. Hold regular (e.g., semesterly) quality review meetings to analyze monitoring data and satisfaction survey results, identify existing problems and root causes. Standardize and promote successful experiences, and propose Corrective and Preventive Actions (CAPA) for failures. Feed these into the next "Plan" stage, initiating a new PDCA cycle. For example, if a particular software installation consistently exceeds the time limit, the root cause might be an oversized installation package. The improvement measure could be pre-installing it on some images or providing a high-speed internal network download source.

IV. EXPECTED APPLICATION EFFECTS

The satisfaction of teachers and students has significantly improved, the experimental teaching process has become smoother, and the service quality has been enhanced. By standardizing processes, communication costs and redundant operations have been reduced, and the use of automated tools has lowered manual labor intensity. By optimizing resource allocation, the laboratory's equipment procurement, software updates, and manpower configuration can be made more scientific and reasonable.

CONCLUSION

Applying Total Quality Management (TQM) theory to the management of computer laboratories in universities is a profound transformation and innovation of traditional management models. It can effectively solve many problems in the current laboratory operation, promote the transformation of the laboratory from a "cost center" to a "value center", and upgrade from "ensuring teaching" to "empowering innovation". Despite facing many challenges during the implementation process, as long as we adhere to the principles of systematic planning, step-by-step implementation, and continuous improvement, it will undoubtedly provide a more solid and efficient support platform for talent cultivation and scientific research in universities.

References

[1] Yuan Jianmin, Shen Yang. Application of Cloud Desktop in University Computer Room Management,Digital Technology & Application.No.42,2024

[2] Zhong Jundi, Chen Huaxu, Li Hongyuan. University laboratories TQM security construction and management based on information technology, Laboratory Science, Vol.24, No.1, Feb.2021