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# Organization Of Quality Management In Engineering Education Based On PDCA

B. I. Abdukhalikov
Joint Belarusian-Uzbek Intersectoral Institute of Applied Technical Qualifications in Tashkent, Uzbekistan

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**Abstract:** The article examines issues of organizing a quality management system for engineering education based on the PDCA cycle (Plan-Do-Check-Act). It analyzes the theoretical foundations of applying the Deming cycle in the educational environment and the specifics of implementing each stage of the cycle in the context of engineering training. Practical recommendations for implementing a continuous improvement system for the educational process quality are presented.

**Keywords:** Quality management, engineering education, PDCA cycle, Deming cycle, continuous improvement, educational quality system.

**Introduction:** In modern conditions, improving the quality of engineering education is one of the priority tasks in developing the higher professional education system. Globalization of the labor market, rapid technological development, and increasing employer requirements for graduate competencies necessitate the implementation of effective quality management systems in educational organizations [1, p. 45].

One of the most effective approaches to quality management is the application of the PDCA cycle (Plan-Do-Check-Act), developed by W. E. Deming based on W. Shewhart's ideas. This cycle represents an iterative methodology for continuous process improvement and is widely used in various industries, including education [2, p. 112].

**Theoretical Foundations of the PDCA Cycle**

The PDCA cycle (Plan-Do-Check-Act), also known as the Deming cycle or the Shewhart-Deming cycle, is a four-stage model of continuous process improvement [3, p. 78]. Each stage of the cycle performs a specific function in the quality management system:

**Plan** (Planning) – the stage at which current state analysis is conducted, problems are identified, goals are set, and an action plan for achieving them is developed [4, p. 156].

**Do** (Execution) – implementation of the developed plan, introduction of changes into the educational process.

**Check** (Verification) – monitoring and evaluation of the results of implemented changes, comparison of actual results with planned ones [5, p. 89].

**Act** (Action) – making decisions based on obtained results: standardization of successful changes or adjustment of the approach in case of failure.

A distinctive feature of the PDCA cycle is its cyclical nature, which assumes constant repetition of stages, ensuring continuous process improvement [6, p. 203]. Application of this approach in engineering education allows for systematic improvement of specialist training quality.

**Application of PDCA in Engineering Education**

**Planning Stage (Plan).** At the planning stage, the educational organization conducts a comprehensive analysis of the current state of educational programs, identifies discrepancies with professional standards requirements and employer expectations [7, p. 67]. Key elements of this stage include:

– analysis of requirements of federal state educational standards and professional standards; – study of employer needs and labor market demands; – assessment of student preparation levels and identification of problem areas; – formation of measurable goals and educational quality indicators [8, p. 134].

At this stage, it is important to ensure participation of all stakeholders: faculty, students, employers, and

administrative personnel. This allows for forming a comprehensive vision of problems and ways to solve them.

**Execution Stage (Do).** The execution stage involves implementing the developed action plan. In the context of engineering education, this may include [9, p. 178]:

– updating educational program content considering modern technologies; – introducing innovative teaching methods (project-based learning, case method, problem-oriented learning); – modernizing the material and technical base of laboratories and classrooms; – professional development of teachers; – developing practice-oriented learning through partnerships with enterprises.

An important aspect of this stage is thorough documentation of all actions taken and recording of intermediate results [10, p. 94]. This ensures the possibility of subsequent analysis of measure effectiveness.

**Verification Stage (Check).** The verification stage is aimed at assessing the effectiveness of implemented changes. Various assessment methods are used in the engineering education system [11, p. 145]:

– analysis of student academic performance and dynamics of knowledge quality indicators; – conducting intermediate and final assessments using a competency-based approach; – surveying students, employers, and teachers to assess educational process quality; – monitoring graduate employment and career growth; – analyzing employer feedback on specialist training quality [12, p. 201].

Critical is the use of objective quantitative and qualitative indicators that allow obtaining a reliable picture of results. Comparing actual indicators with planned goals allows determining the degree of success of implemented measures.

**Action Stage (Act).** At the final stage of the cycle, decisions are made based on verification results. If implemented changes showed positive results, they are standardized and formalized in the educational organization's normative documents [13, p. 167]. In case of identified shortcomings, corrective measures are developed, and the cycle resumes.

The action stage also involves summarizing the gained experience, disseminating best practices within the organization, and forming new goals for the next improvement cycle [14, p. 89]. Thus, continuity of the educational quality improvement process is ensured.

**Practical Aspects of Implementation**

Successful implementation of the PDCA cycle in the quality management system of engineering education requires meeting several conditions. First, support from educational organization leadership and formation of a quality culture at all levels is necessary [15, p. 234]. Second, it is important to ensure involvement of all participants in the educational process in quality improvement activities.

A critical success factor is creating an effective system for data collection and analysis. Modern information technologies allow automating monitoring processes and report generation, which significantly increases the efficiency of management decision-making [16, p. 178].

Special attention should be paid to training personnel in the principles and methods of working within the PDCA cycle. Understanding the philosophy of continuous improvement and possessing appropriate tools are necessary conditions for effective implementation of the quality management system [17, p. 123].

**CONCLUSION**

Application of the PDCA cycle in organizing quality management of engineering education represents an effective mechanism for continuous improvement of the educational process. Systematic implementation of planning, execution, verification, and action stages allows educational organizations to flexibly respond to changing labor market requirements and ensure high quality of engineering personnel training.

Successful implementation of the PDCA cycle requires a comprehensive approach, including formation of a quality culture, involvement of all participants in the educational process, creation of an effective monitoring system, and personnel training. When these conditions are met, the PDCA cycle becomes a powerful tool for increasing the competitiveness of an educational organization and the quality of graduate training.

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