Teaching Reform of College Curriculum Based on PDCA Model

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Abstract. Curriculum teaching is an important part of cultivating talents in higher education, and it has become a common choice in higher education to construct a scientific teaching model to meet the needs of cultivating talents in the discipline. This study takes the PDCA (Plan-Do-Check-Action) model as the theoretical basis, analyzes the key elements of the new engineering background in depth, and systematically builds a teaching model covering the course objectives, course design, implementation of teaching activities, multi-dimensional evaluation of the course, feedback of the course quality information processing, and continuous improvement, aiming at guiding the teaching of the course to adapt to the fast-changing scientific, technological and social environment, steadily improving the teaching quality of colleges and universities, and providing students with a better quality of teaching in the context of the new engineering background. It aims to guide the teaching of courses to adapt to the rapidly changing technological and social environment, steadily improve the quality of teaching in colleges and universities, and provide a better learning experience for students in colleges and universities in the context of new engineering.

Keywords: Emerging Engineering Education; PDCA Model; College Curriculum; Teaching and Learning Reforms

1 Introduction

"Emerging Engineering Education, 3E" is a system of new engineering disciplines, which represents a modernized concept of engineering education, aiming to cultivate engineers and scientific and technological leaders with innovative abilities and comprehensive literacy who can adapt to the rapidly changing needs of science, technology and society. The new engineering education model emphasizes the cultivation of students' interdisciplinary ability, practical ability, innovation ability and sense of social responsibility. New Engineering is responding to the challenges of technological advancement and globalization in the field of engineering by developing engineers with comprehensive literacy, innovation and adaptability to meet the ever-changing needs of society and the market. This educational concept has been widely promoted and adopted globally and is considered to be the future direction of engineering education.

In the context of the new engineering disciplines, university teaching is faced with a series of new challenges, such as interdisciplinary integration, practice orientation, innovative

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education, continuous learning, etc., which need to be adapted to the rapidly changing technological and social environment. These challenges require colleges and universities to continuously improve their curriculum design, teaching methods, and assessment systems to ensure that students graduate with the skills and qualities required by the new engineering disciplines.

2 Objectives of the curriculum reform

Tertiary institutions provide more challenging and practically rewarding learning experiences through curricular reforms to improve the quality of education and ensure that students acquire more comprehensive knowledge and skills. Adapting the content and structure of curricula in response to changing societal and occupational needs makes it easier for graduates to find jobs and become competent in their future careers. Creative teaching methods and curriculum design can stimulate students' interest and enhance their engagement and motivation to learn. Effective assessment mechanisms are established to help schools and teachers understand the effectiveness of the curriculum so that necessary improvements and adjustments can be made. The main text should be written using Times New Roman, 10pt, fully justified. Italics can be used for emphasis and bold typeset should be avoided**[1]**.

Aiming at the new challenges of teaching in colleges and universities brought about by the new engineering discipline, the closed-loop system of "Plan - Do - Check - Action" of total quality is utilized to carry out teaching reform. Teaching reform aims to systematically build an innovative teaching model for college courses in terms of course objectives, course design, implementation of teaching activities, multi-dimensional evaluation of courses, feedback of course quality information processing and continuous improvement**[2][3]**. The aim is to provide a more challenging and practical education that meets the needs of the times, so as to cultivate students with creativity and comprehensive qualities and enable them to better adapt to the ever-changing social and professional environment.

3 Objectives of the curriculum reform

In-depth analysis of the key elements of college curriculum teaching in the context of new engineering disciplines, Following the closed-loop system of "Plan-Do-Check-Action" of total quality management, we systematically constructed a curriculum teaching model covering curriculum objectives, curriculum design, implementation of teaching activities, multidimensional evaluation of the curriculum, feedback on the handling of information on curriculum quality, continuous improvement, as shown in **Figure 1.** PDCA Teaching Model. The PDCA Teaching Model of Curriculum Teaching aims at standardizing and guiding the steady improvement of the quality of the curriculum, and providing learners with better curriculum content and services in the context of the new engineering disciplines**[4]**.

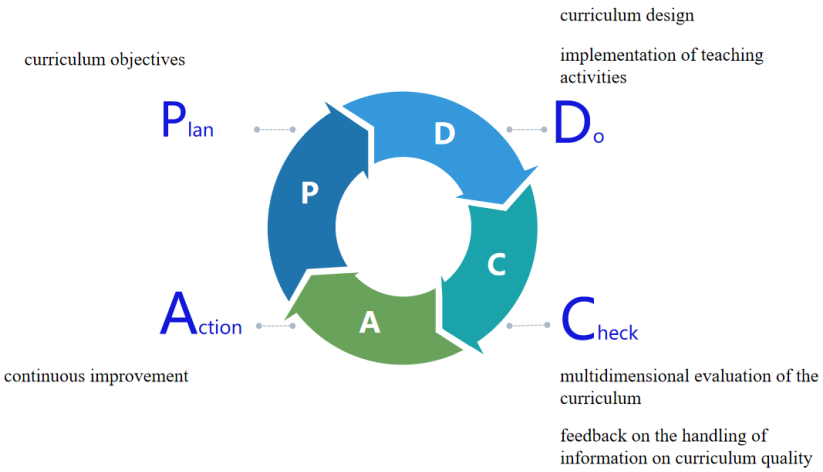

Fig. 1. PDCA Teaching Model

4 Pathway for the implementation of the curriculum model

4.1 Setting course objectives (Plan)

In the PDCA teaching model, the Plan stage corresponds to the development of course objectives. In this planning stage, the following six points need to be considered comprehensively:

1. Educational objectives: Educational objectives must be consistent with the core concepts and practical requirements of the relevant disciplines, and include objectives in a variety of areas such as knowledge, skills as well as qualities.

2. student needs: in-depth understanding of the ability background and learning needs of the target student group to ensure that the designed curriculum content and teaching methods can meet their academic and vocational needs.

3. Disciplinary developments and trends: In order to keep the curriculum at the forefront, it is necessary to pay close attention to the latest developments and trends in related disciplinary fields, including technological innovations, the evolution of design methodologies, and the dynamic changes in user experience.

4. Teaching resources: In order to guarantee adequate support for student learning, the availability and applicability of the resources needed for teaching need to be assessed regularly, which include teaching materials, experimental equipment, software tools, etc.

5. Teaching team: Ensure that the teaching team has sufficient professional knowledge and rich teaching experience to fulfill the teaching tasks of the course, which also requires regular assessment of professional background and teaching competence.

6. Course structure and arrangement: Establish a reasonable course structure and time schedule to ensure organic articulation of course content and learning progression, as well as scientific allocation of teaching resources and time.

4.2 Designing and implementing teaching and learning activities (Do)

In the PDCA teaching model, the Do stage corresponds to the design and implementation of teaching activities. In the context of new engineering, the following five points should be comprehensively considered in the stage of formulating the curriculum implementation plan:

1. Teaching methods: Choose appropriate teaching methods and strategies to encourage students' active participation and interaction. According to the curriculum objectives and the characteristics of students, choose appropriate teaching methods, such as case studies, practical projects, group discussions, laboratory practice, etc., to improve the learning effect of students.

2. Teaching resources: Ensure that the required teaching resources and equipment can be provided effectively. Teachers should prepare and deploy necessary teaching resources in advance, including teaching materials, software tools, experimental equipment, etc., to support students' learning and practice.

3. Student Support: Provide students with the support and guidance they need to help them overcome difficulties and challenges in their learning. Teachers can set up office hours, provide online communication platforms, and conduct activities such as student counseling and seminars to promote communication and interaction between students and teachers.

4. Course evaluation: Establish effective course evaluation and feedback mechanism to understand students' learning situation and course effect. Through quizzes, assignments, project assessments and other means to collect students' academic achievements and feedback, timely adjustment of teaching strategies and provide personalized learning support.

5. Course management: Establish a course management mechanism to ensure the orderly conduct of courses. This includes aspects such as managing course progress, maintaining student learning records, updating and maintaining course materials and resources to improve the organization and continuity of the course.

4.3 Course Evaluation and Information Data Statistics (Check)

In PDCA teaching mode, Check stage involves course evaluation and information data statistics. In the course of the course review, the following key points need to be fully considered:

1. Student learning outcome assessment: Students' academic performance is assessed and checked to understand their mastery of the course content and the application of their ability. Assessment can include exams, assignments, project assessments, etc. Students can be assessed regularly or irregularly to obtain their performance and achievement in the course.

2. Evaluation of the achievement of curriculum objectives: evaluate the realization of curriculum objectives and judge whether curriculum design and teaching strategies can effectively promote students' learning and development. Through quantitative or qualitative

evaluation of specific indicators of curriculum objectives, the effectiveness of curriculum design can be determined and direction can be provided for further improvement.

3. Student feedback and opinion collection: Actively solicit feedback and suggestions from students to understand their learning experience and course views. The feedback information of students was collected by means of curriculum evaluation questionnaire, group discussion and interview, so as to obtain their views on course content, teaching methods and teachers, and provide a strong basis for curriculum improvement and optimization.

4. Teaching resources and teaching reflection: evaluate the full use and effect of teaching resources, and conduct in-depth reflection on the problems and improvement directions in the teaching process. Teachers should carefully evaluate the effectiveness of teaching resources, the applicability of teaching materials and the feasibility of practical links, and reflect on their own performance in teaching and the implementation effect of teaching strategies in order to make corresponding adjustments and improvements.

5. Course evaluation and quality assurance: Comprehensively evaluate the quality and effectiveness of the entire course to ensure continuous improvement and enhancement of the course. Through the evaluation and analysis of the whole course, combined with the feedback of students, the situation of teaching resources and teaching reflection and other information, the specific measures and optimization strategies for curriculum improvement are formulated.

6. Information Data statistics: Objectively collect and statistically evaluate data to ensure effective course improvement and enhancement. Data statistics can be presented visually, not only improving the comprehensibility of the data, but also helping users discover new insights, make better decisions, and communicate information effectively. In this study, data statistics are presented in the form of visual radar map, for example, as shown in **Figure 2.**Information statistical radar map.

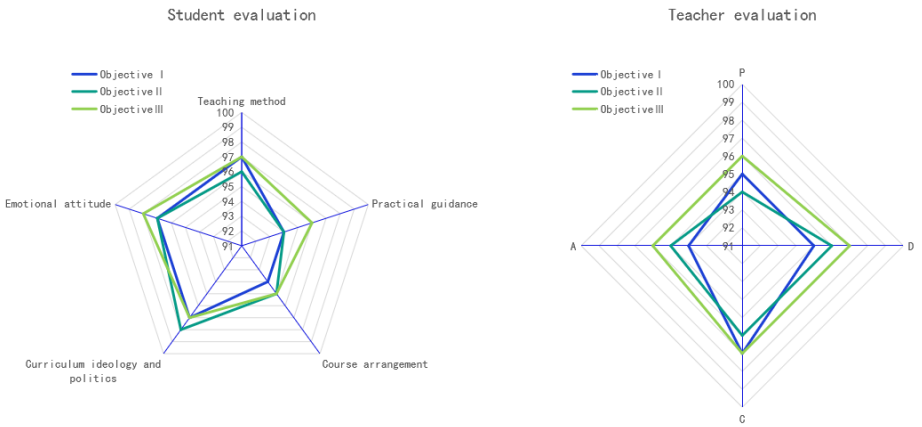

Fig. 2. Information statistical radar map

4.4 Continuous improvement (Action)

In the PDCA teaching model, Action represents the continuous improvement of the curriculum. In the continuous improvement phase of the curriculum, the following key points need to be fully considered:

1. Update of teaching resources: Timely pay attention to and apply the latest teaching resources and technologies, including teaching materials, teaching AIDS, multimedia technology, online learning platform, etc. Ensure that teaching resources are aligned with course objectives and content and can effectively support students' learning and practical activities.

2. Analysis of data feedback: Conduct in-depth analysis of course feedback data, including student evaluation, academic performance, course performance, etc. Based on the analysis results of the data, explore the development direction of the course and the existing problems, understand the needs of students and feedback, and provide a basis for improvement measures.

3. Make improvement plan: Make specific improvement plan according to data feedback and analysis results. Clearly define the improvement objectives, measures and time plan to ensure the pertinence and operability of the improvement measures. We can take a step by step improvement approach, carry out a small scale pilot, and then gradually promote and apply.

4. Implement improvement measures: Implement improvement measures purposefully according to the improvement plan. We can adjust the teaching strategy, optimize the course design, update the teaching resources and improve the evaluation methods, so as to improve the quality of the course and the learning effect of the students.

5. Monitoring and evaluating the improvement effect: monitoring and evaluating the implementation effect of the improvement measures. Collect relevant data and information, compare the differences and effects before and after improvement, and evaluate the effectiveness and effectiveness of improvement measures. Based on the evaluation results, further adjustments and improvements will be made.

6. Continuous feedback and improvement: continuous feedback and communication with students, colleagues and experts, listening to their opinions and suggestions. According to the feedback and suggestions, timely adjust the improvement direction and strategy, and keep the continuous improvement and innovation of the course.

5 Course Instructional Model Improvement Process

The curriculum teaching mode based on the PDCA model involves all aspects of the implementation of the curriculum, and the person responsible for its improvement process is mainly the person in charge of the curriculum. Because the course teaching mode is the center of the whole teaching improvement, its improvement process is inseparable from the whole mode, and the specific operation mode is shown in **Figure 3.** PDCA teaching mode improvement process.

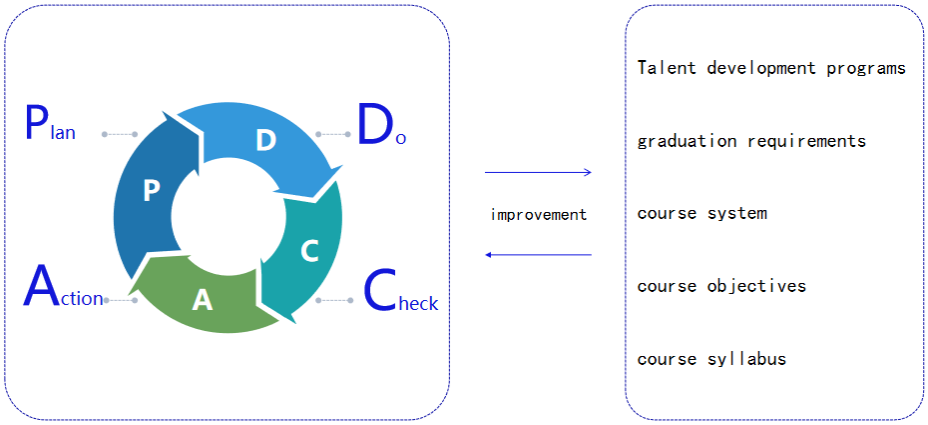

Fig. 3. PDCA teaching mode

Curriculum teaching based on the PDCA model is realized through the core links of formulating course objectives, designing and implementing teaching activities, course evaluation and information data statistics, continuous improvement, and forming a closed-loop curriculum quality improvement and enhancement system. Through the continuous improvement measures of the PDCA teaching model, a comprehensive closed-loop of course improvement has been formed, including the evaluation and revision of the Talent development programs, graduation requirements, course system, course objectives, course syllabus and other links, in order to ensure the continuous improvement of the course and the smooth implementation and operation**[5][6]**.

6 Conclusions

Engineering education has always been closely related to the economic and social development of the country, and it is bound to evolve as industries evolve. In the traditional machine-industry era, engineering education mainly focused on cultivating specialized knowledge and skills in engineering technology. In the information age, engineering problems

have become more complex, and many of them require breakthroughs in science to be truly solved. In the context of New Engineering, engineering problems are no longer just technical or scientific problems, but complex problems closely linked to human, social and natural environments. Therefore, the essence and core of engineering problems can only be truly understood in a broader perspective.

New engineering education inevitably requires significant changes in educational content, teaching mode, teaching methods and learning styles to better meet the needs of new engineering talent training. This includes paying more attention to cultivating students' core qualities such as creative thinking. The PDCA teaching model constructed in this study aims to promote the effective realization of course objectives, improve and enhance the quality of education, and thus contribute to the cultivation of high-quality and diversified new engineering talents in China.

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