Design of 4P-BL Teaching Mode with Four Integration

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Abstract: In view of the Ministry of Education "one degree for both sexes" and the new engineering construction objectives, cultivating applied undergraduate talent initiative, initiative and solve practical engineering problems become the focus. Taking the Introduction to Big Data Technology course of Geely University as an example, this paper studies the innovative design of 4P-BL teaching mode based on four-integration and the five-step teaching method.

1. INTRODUCTION

The Central Committee of the Communist Party of China and the State Council have printed and distributed the China Education Modernization 2035[1], stressing that we shall firmly implement the strategy of invigorating the country through science and education and the strategy of reinvigorating the country through human resources, and the Twentieth National Congress of the Communist Party of China has put forward the strategic goal of Chinese-style modernization construction, and the "four new" courses[2] have become the main theme. Based on this background, the Ministry of Education put forward the requirements of "Golden Course" construction, and "Fudan Consensus" and "Tianda Action" became the new path of higher education reform[3]. Under the digital economic model characterized by new industries, new technologies, new models and new business forms, data governance becomes a new atmosphere of industrial development by using big data technology. The explosive growth of data makes the problem model of engineering application more and more complicated, especially the big data-related engineering education[4] raises higher requirements for cultivating and leading the future of both computing thinking, big data-related thinking, Internet thinking, open thinking, innovative thinking, engineering thinking, scientific literacy and legal ethics. Introduction to Big Data Technology is a basic course of computer science. Curriculum reform should respond to the needs of new engineering courses and strive for innovation.

2. PROBLEMS IN TRADITIONAL CLASSROOM

2.1 Low participation of students in curriculum learning and insufficient intrinsic learning drive

In the traditional classroom-centered, teacher-centered and textbook centered classroom, students' learning goals are not clear, their learning motivation is not enough, and they lack initiative and active learning consciousness[5]. In the learning process cannot be timely on their own learning self-supervision and self-control, resulting in low participation in the entire curriculum learning, learning passive, negative.

2.2 Emphasizing the teaching of knowledge and neglecting the training of engineering practice ability

Emphasizing theory over practice[6] is a common phenomenon in higher education. In the whole learning process, there is no effective guidance for practical application. Practical cases are too traditional and simple for students to combine curriculum practice with engineering application.

2.3 The course evaluation method is single, and it is difficult to measure the effect of process learning

The whole course evaluation method is single[7], often for the final fraction theory, leading to serious students cheating. In addition, curriculum assessment focuses on the results, ignoring the process, curriculum lack of challenge, process or stage learning results difficult to evaluate and measure.
2.4 Curriculum implementation neglects value shaping and curriculum education function is not perfect

The curriculum only pursues knowledge accumulation and ability cultivation, but neglects humanistic quality education\(^8\), resulting in students' lack of social responsibility, moral sense, personal responsibility, professional quality\(^9\) and other important educational values unable to be effectively cultivated and difficult to integrate into society.

3. DESIGN OF 4P-BL TEACHING MODE WITH FOUR INTEGRATION

Aiming at the appealing problem, this paper constructs the 4P-BL teaching mode based on the ideas of OBE\(^{10}\) and PBL\(^{11}\)\(^{12}\) and carries out the teaching activities through the five-step teaching method. Curriculum pattern design focuses on the reconstruction of teaching content, the reform of teaching methods, the integration of teaching resources, curriculum design, as shown in Figure 1.

As can be seen from Fig. 1, the design is constructed from two aspects: "how teachers teach" and "how students learn". The teaching is based on guiding, heuristic, task-based and case-based forms. Based on question, participation, project and situation, students realize learning process, active learning, doing in learning, debate learning, project practice, and finally knowledge internalization and transfer. Teaching process is based on MOOC and online and offline hybrid teaching\(^{13}\), to achieve from the entity to the classroom overturn. Through the implementation of the curriculum, students will ultimately have the six core abilities of curriculum objectives.

3.1 Curriculum content reconstruction

(1) Curriculum integration, keep abreast of the times, and meet the high-level nature of courses. Based on the needs of application-oriented talents, we fully investigate the cutting-edge technology of the course and integrate the project cases, industry standards and evaluation content. Under the guidance of guaranteeing the foundation, embodying the advanced, combining with the reality, guiding the innovation and using the learning, the course content is organically integrated according to the two main lines of data-model-mining, theoretical base-analysis-designing, so as to promote the frontiers and times of the course and satisfy the higher level of the course.

(2) Curriculum expansion, introduction of engineering and cosine to enhance curriculum innovation and challenge. In the process of teaching, we should expand the curriculum, add practical activities, project design, project case analysis and so on, let students participate in innovative and challenging competitions. According to the engineering practice and the demand of science and technology competition, the students' interest and practical ability can be promoted. Cultivate students' comprehensive ability and high-level thinking ability, realize the sublimation from explicit knowledge to tacit knowledge, and enhance the innovation and challenge of curriculum.

3.2 Reform of teaching methods

Based on the product-oriented (OBE) and problem-driven (PBL), a 4P-BL teaching method is proposed. Through project-based, problem-oriented, and student-oriented teaching activities, this paper constructs situational teaching activities, and adopts the "five-step teaching method" of teacher guidance, question thinking, group discussion, individual practice and feedback improvement to carry out the teaching activities, so as to realize the teaching process of "student-centered", such as Figure 2.
Among them, through the introduction of "set questions" problem-driven, through "thinking" to stimulate students to think about the problem to cultivate independent inquiry, through "discussion" to enhance students' classroom participation and the ability to analyze the problem, through "realization" to train students to solve the problem, through "feedback" to find the inadequacies, put forward improvement programs, stimulate students' awareness of innovation. Teachers create the situation by setting up "questions" and "introducing thoughts". Students can form their own achievements through individual study or group study. Teachers give in-depth feedback by evaluating, supplementing and correcting students' accomplishments. Teachers guide students to think again to complete the internalization of knowledge and achieve the goal of knowledge transfer.

3.3 Integration of curriculum resources

Integrate the resources of the cases of enterprises cooperating with enterprises, excellent cases of scientific competitions and industrial standards, construct classroom teaching scenarios (including online and offline ones), create problems, design curriculum activities, and construct classroom learning lines to arouse students' interest. Integrate the MOOC resources of Chinese college students and the fragmented learning resources of the Internet (such as Station B, webpage materials), and construct the knowledge system of online superstar learning self-inquiry, so as to stimulate students' self-learning ability. Based on the 4P-BL teaching method, the dynamic teaching of online and offline flipping is completed to promote students' enthusiasm for participating in the class. Collate the information of scientific research, provide students with the direction of scientific research, construct the teaching of scientific research, promote the ecological system of scientific research\(^{[13]}\) promote students' deep learning and knowledge transfer.

3.4 curriculum design four integrations

Through the integration of curriculum content and project cases, teaching implementation and online and offline, evaluation and industry standards, knowledge learning and ideological education, curriculum design is carried out.

1. Integration of curriculum content and project cases. The project case includes enterprise engineering case, scientific research project case and student competition winning case. It integrates the project case into the course content and constructs the scene of the course. Through curriculum practice, we can incubate scientific research projects and competition subjects, form the mode of scientific research back-nurturing teaching, promote scientific research by teaching, tap students' passion for learning, cultivate students' ability to analyze and solve engineering problems, and gradually improve their engineering design, evaluation and innovation ability to achieve the goal of knowledge transfer. Course case introduction is shown in Table 1.

2. Teaching shall be integrated online and offline. The teaching process is based on 4P-BL teaching method, "student-centered", implementing problem-driven curriculum teaching, using MOOC, wisdom classroom, rain classroom, online and offline, classroom and extracurricular mixed teaching, to develop students' ability of independent learning, cooperative learning, independent exploration.

3. Integration of evaluation contents and industry standards. Through the Ministry of Education's established production-study-research cooperation project, the evaluation mechanism of industry-teaching integration based on industry standards shall be formulated jointly with enterprise experts. Professional teachers and enterprise engineers shall, according to the needs and standards of the industry, analyze the positions and abilities of big data applied talents, and work out the periodical and process-based assessment standards. At the same time, encourage students to participate in the MIIT big data engineer certificate examination. Through the
certificate, not only to meet the requirements of the curriculum assessment and industry certification requirements, while training students in professional literacy.

(4) Integration of knowledge learning and ideological and political education. Taking theoretical teaching as the starting point, not only "teaching" and "puzzling", but also "preaching" in the first place, to help students to establish a correct outlook on the world, outlook on life and values; taking practical teaching as the starting point, to enable students to realize the impact of engineering on society, health, safety, law and culture and understand its responsibilities when solving complex engineering problems. Taking policy and legal knowledge interspersed courses to enable students to understand the development of the country, have a sense of home and country, develop professional habits, ideas and politics integrated as shown in Table 2.

<table>
<thead>
<tr>
<th>Curriculum Chapters</th>
<th>Ideological Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 1 Nature of Computational Thinking</td>
<td>Chinese core case</td>
</tr>
<tr>
<td>Chapter 2 From Computing to Cloud Computing</td>
<td>Internet plus platform for action, Internet plus policy documents</td>
</tr>
<tr>
<td>Chapter 3 Internet to Internet accelerated speed</td>
<td>The great weapon of the state</td>
</tr>
<tr>
<td>Chapter 4 From Data to Big Data</td>
<td>Civil code: privacy and copyright</td>
</tr>
<tr>
<td>Chapter 5 From Intelligence to Artificial Intelligence</td>
<td>Computer ethics</td>
</tr>
<tr>
<td>Chapter 6 From Distributed to Distributed Systems</td>
<td>Enforced and the connotation of electoral law</td>
</tr>
<tr>
<td>Chapter 7 Distributed Parallel Computing MapReduce</td>
<td>Report and word frequency analysis the development of domestic smart cars</td>
</tr>
</tbody>
</table>

4. TEACHING IMPLEMENTATION AND EVALUATION

4.1 EACHING IMPLEMENTATION

Based on the 4P-BL teaching method, the five-step teaching method is applied in the teaching process before, during and after class. shown in Figure 3 (The course implementation architecture) and Figure 4 (the implementation process).
**Pre-class stage:** The project case into the classroom creation scenario, the design of pre-class learning PPT, through Super Star Learning Pass release preview tasks, students use Chinese college students MOOC to complete the pre-class knowledge learning, through the rain class course learning and statistical survey, the use of QQ group to complete the course.

**Mid-class stage:** Integrate the project cases, industry standards, professional accomplishment and Sai Chuang into classroom setting activities, and mainly complete typical tasks and Q&A testing. Question answering test is based on the statistical problems and key knowledge before and after class. Knowledge points create situational knowledge activities and use scaffolding guidance for learning. Typical task: Students complete the self-inquiry according to the situation activity, realize the construction of knowledge system, complete the cooperative/cooperative learning with the peer, participate/share with the teacher and peer to complete the teacher-student-student knowledge construction.

**After-class stage:** After class, release review task, chapter detection homework, complete the competition task. Students can test the related chapters through the superstar system, answer questions online by QQ group, discuss the topic through the rain class, and make a follow-up study plan. The whole after-school stage is the stage of knowledge raising and creation, which fully guides students to realize thinking innovation.

**4.2 Evaluation System**

Based on the above design concept, "Big Data Technology Introduction" has constructed the curriculum evaluation system. The evaluation system is divided into three stages: before class, during class and after class. The data of learning process, learning participation and learning effect are collected. Using the results of the display of the whole teaching design feedback, reflection, optimization, and then build can be optimized, evaluable, circular teaching evaluation mechanism, as shown in Figure 5.
As can be seen from the picture above, the data collected include the data of students' study trace, study results and discussion participation. Students' study trace data, achievement score data, test result data, class evaluation data, activity result data and study participation data. Students' learning trace data, learning achievement data and learning evaluation data after class. The data of learning behavior, learning effect and learning evaluation are integrated to get three levels of data. Using the data analysis method to score the data intelligently and verbally, the learning performance evaluation model is obtained. Learning performance evaluation model is used to evaluate students' autonomous learning, learning participation and learning effect in the three stages before, during and after class.

4.3 Evaluation mechanism

The assessment system adopts the "four-dimension" assessment model to assess the whole learning process, including four dimensions: process assessment, evaluative assessment, achievement assessment and result assessment. The assessment methods include daily assessment, individual assessment and team assessment, and the assessment scoring system includes the bonus point system and the demerit point system, as from Table 3.

![Fig.5 Evaluation system of classroom teaching activities](image.png)

<table>
<thead>
<tr>
<th>Category</th>
<th>Assessment Items</th>
<th>Form of Assessment</th>
<th>Assessment Methods</th>
<th>Weight</th>
<th>Grading standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process assessment</td>
<td>Classroom performance</td>
<td>(Rain Class) Preemptive response</td>
<td>Daily assessment, team play + individual play</td>
<td>25%</td>
<td>Addition and subtraction system Each team and individual activity plus or minus 1-5 points, the team has full autonomy, voting members again team situation</td>
</tr>
<tr>
<td></td>
<td>Online learning (Rain Class)</td>
<td>(Superstar Study + College Student Course) Pre-class learning and testing</td>
<td>Daily assessment, individual + team</td>
<td>20%</td>
<td>Point system Add 1-5 points depending on performance</td>
</tr>
<tr>
<td></td>
<td>After-class test</td>
<td></td>
<td>Daily assessment, personal battle</td>
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<tr>
<td>Evaluative assessment</td>
<td>assessment based on evaluation mechanism</td>
<td>(Rain Class) Teacher student coevaluation Establishment mutual evaluation Intra-group evaluation NPC evaluation</td>
<td>Routine assessment</td>
<td>5%</td>
<td>Point system Grading 1, 3 and 5 each time according to the evaluation results</td>
</tr>
<tr>
<td>Achievement assessment</td>
<td>Peacetime experiment</td>
<td>(QQ group) Content of practice Project content Achievement transformation (Competition)</td>
<td>Phased Outcome Assessment, Individual Combat + Team Play</td>
<td>20%</td>
<td>Point system Achievement transformation may be given extra points, which shall be given according to the category of achievement, but shall not be higher than 20% until the usual points are added</td>
</tr>
<tr>
<td>Resultant assessment</td>
<td>Final assessment</td>
<td>Written examination Outline scope</td>
<td>Closed volume</td>
<td>30%</td>
<td>Examination paper score</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 Curriculum Assessment Mechanism
This course focuses on the process of assessment, fully tracking students' enthusiasm and participation in the learning process. Each achievement not only exercises students' ability of independent inquiry, but also guarantees students' active participation. The process assessment, the evaluation assessment and the achievement assessment, which are composed of the score, are normalized to the highest score of the students in the class, and the final score is calculated.

5. TEACHING RESULTS

Through the curriculum implementation of teachers and students to achieve co-existence and co-integration. As far as the teachers' team is concerned, based on the curriculum teaching, the teachers' team has successfully applied for 6 projects of educational reform and scientific research, authorized 3 invention patents, published 5 papers of PKU core and above, and won 2 prizes. As far as students are concerned, Class A competitions have won 9 prizes, 10 research and development projects, 3 school-level scientific research projects, 2 authorized software copyrights, 3 provincial undergraduate innovation training projects and 1 national undergraduate innovation training project. Therefore, this teaching mode can bring the student-centered teaching idea into full play, mobilize students' subjective initiative, and actively participate in the classroom.

6. CONCLUSION

This paper proposes a new 4P-BL teaching model, which integrates the curriculum content with project cases, online and offline teaching implementation, evaluation content with industry standards, knowledge learning and ideological and political integration to realize the curriculum reconstruction, integrates the resources such as superstar, rain classroom, college students' course-admiring and Internet knowledge, creates a multi-interwoven learning environment, combines the five-step teaching method based on the 4P-BL teaching method to stimulate students' enthusiasm and enthusiasm for learning, gives full play to the initiative of learning, and teachers' teaching dominance.

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REFERENCES


13. LI Qiang, XU Wanzhen, SHEN Hongrui. Exploration and practice of "scientific research feeds teaching"
mode in application-oriented colleges. [J]. Computer
Engineering & Science,
14. LIU Xiaotang, YU Linliang, CHEN Jie. Systematic
Construction of Course Ideological and Political
Education and Teaching Practice of Inorganic
Chemistry Based on OBE. [J] Chinese Journal of
Chemical Education, 2023, 44(06):17-23.
DOI:10.13884/j.1003-3807hxjy.2022030038.
15. WANG Jinlan. On the Strategies of Moral Education
in Primary Schools under the Background of Core
Accomplishment [J]. Education Guide, 2021(32):65-
66.