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# Reform and Optimization of the Course "Network Engineering Project Training" under the Goal of Applied Talent Cultivation

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**Abstract:** As a core course for the network engineering major that connects theory with practice, cultivates students' engineering literacy and fosters core post competencies, the teaching quality of Network Engineering Project Training is directly related to the overall effect of applied talent cultivation. Therefore, this paper clearly and hierarchically sorts out the existing problems of the course, such as the disconnection between training content and post demands, a single and rigid teaching model, weak practical competence of teaching staff, and an imperfect assessment system. Taking the cultivation requirements of applied talents for "emphasizing practice, strengthening application and fostering innovation" as the fundamental starting point, it systematically and solidly puts forward reform ideas from four dimensions: the reconstruction of course content, the innovation of teaching model, the construction of teaching staff, and the optimization of assessment system, which are verified by teaching practice. The empirical results clearly show that the optimized course has effectively improved students' engineering practical ability, post adaptability and innovative awareness, thus providing a referable, replicable and effective path for the reform of practical training courses for the network engineering major in application-oriented undergraduate universities.

**Keywords:** Applied Talents; Network Engineering Project Training; Teaching Reform; Post Competence; Engineering Literacy.

## 1. Introduction

The rapid development of the digital economy has driven the in-depth penetration of network technology into all fields of society, and the market demand for applied talents in the field of network engineering has been rising continuously. The talent standard has shifted from mere mastery of theory to a combination of solid theoretical foundation, strong engineering practical ability, problem-solving ability and team cooperation ability. Application-oriented undergraduate universities take cultivating high-quality applied talents for the front line of production, construction, management and service as their core mission [1]. As a core practical course of the major, Network Engineering Project Training undertakes the key role of connecting classroom theory with post operation and shaping students' engineering thinking and practical ability.

At present, application-oriented undergraduate universities basically adopt the traditional teaching model for this course, leading to prominent problems that run counter to the goal of applied talent cultivation in teaching: the training content is inclined to theoretical verification and simulated operation, which is disconnected from the actual post demands of enterprises; the teaching is dominated by teachers' one-way lectures, with students passively accepting knowledge, thus lacking space for active exploration and hands-on practice; the teaching staff are mainly academic teachers in universities and lack practical experience in the front line of enterprises, making it difficult to truly align with post competence requirements; the assessment method is single, focusing on results rather than processes, failing to objectively and fully evaluate students' practical ability and comprehensive literacy [2]. As a result, graduates have a long post adaptation cycle, and the phenomenon of "disconnection between learning and application" is prominent, which directly and seriously restricts the quality of applied talent cultivation.

Taking the goal of applied talent cultivation as the fundamental starting point, this paper analyzes the pain points of the course Network Engineering Project Training in a clear and hierarchical manner, and thus naturally and appropriately puts forward various reform paths such as content reconstruction, model innovation, teaching staff enhancement and assessment improvement, so as to achieve the accurate alignment between course teaching and post demands, effectively improve students' engineering practical ability and post competitiveness, and thus provide an excellent reference for the reform of practical training courses in application-oriented undergraduate universities.

## 2. Analysis of the Existing Problems of the Course Network Engineering Project Training

(1)Disconnection between Training Content and Post Demands

At present, the training content of Network Engineering Project Training in many universities is still dominated by theoretical verification and simulated operation, resulting in most training projects being simple configuration of a single module, such as the basic configuration of routers and switches. Therefore, the course lacks real engineering project training with comprehensiveness and systematicness. The update of training content lags behind, failing to timely and fully introduce new industry technologies and specifications such as cloud computing, virtualization, network security and SDN, and it is also disconnected from the design, implementation and operation and maintenance processes of actual enterprise network engineering projects. More

seriously, the training content is not rationally designed in layers combined with the competence requirements of different posts (network engineer, operation and maintenance engineer, technical support engineer), making it difficult for students to quickly adapt to post demands after graduation, and thus various problems of "learning not being applied" arise.

(2) Single Teaching Model and Weakened Subject Status of Students

The course adopts the typical traditional model of "teachers' lectures + students' imitative operation". Teachers first explain the training objectives, steps and key points, and students mechanically complete the operations according to the instruction manual, thus leaving no real space for independent thinking, autonomous exploration and innovative practice. This neglects the subject status of students, fails to arouse their learning interest well, and is even less likely to cultivate their desire for active exploration [3]. Therefore, students only acquire scattered operational skills, lack engineering thinking and the ability to solve complex problems, and thus cannot truly solve network engineering problems in actual work. More seriously, online teaching resources are not fully utilized, and the integration of online and offline teaching is insufficient, failing to effectively meet students' needs for autonomous and personalized learning.

(3) To-be-improved Practical Competence of the Teaching Staff

Fundamentally speaking, the teaching quality of practical training courses depends on a team of "double-qualified" teachers with solid theoretical foundation and practical ability. Nevertheless, it is undeniable that the vast majority of teachers in the network engineering major of universities are masters and doctors graduated from universities, thus generally lacking direct experience in the design, deployment and operation and maintenance of network engineering in the front line of enterprises, and having an insufficient understanding of enterprise post demands and industry technological trends. Therefore, practical training teaching is difficult to naturally and appropriately align with post competence requirements, and it is also hard to provide practical guidance for students' real project practice [4]. More seriously, some teachers lack the consciousness of active learning and fail to keep up with the new industry technologies and specifications in a timely manner, resulting in the content and methods of practical training teaching often lagging behind the development of the industry.

(4)Imperfect Assessment System and Deviated Evaluation Orientation

At present, the course assessment is still dominated by summative assessment, mainly adopting training reports and operation demonstrations for evaluation, which naturally focuses on examining students' operation results and report quality. Undeniably, however, this assessment method neglects the evaluation of students' training process, practical ability, team cooperation ability, innovative awareness and other elements. Therefore, students are prone to form the wrong understanding of focusing on results rather than processes, perfunctorily complete the practical training, lack the motivation for active exploration and problem-solving, and thus the assessment cannot truly reflect students' comprehensive literacy and post adaptability. [5]

# 3. Strategies for the Reform and Optimization of the Course under the Goal of Applied Talent Cultivation

Combined with the cultivation goal of applied talents for "emphasizing practice, strengthening application and fostering innovation", and in view of the existing problems of the course, this paper puts forward the following reform and optimization strategies from four dimensions: course content, teaching model, teaching staff and assessment system, so as to realize the accurate alignment between course teaching and post demands and improve students' engineering practical ability and comprehensive literacy. The core strategies of curriculum reform under the goal of cultivating applied talents (emphasizing practice, strengthening application, and promoting innovation) are shown in Figure 1.

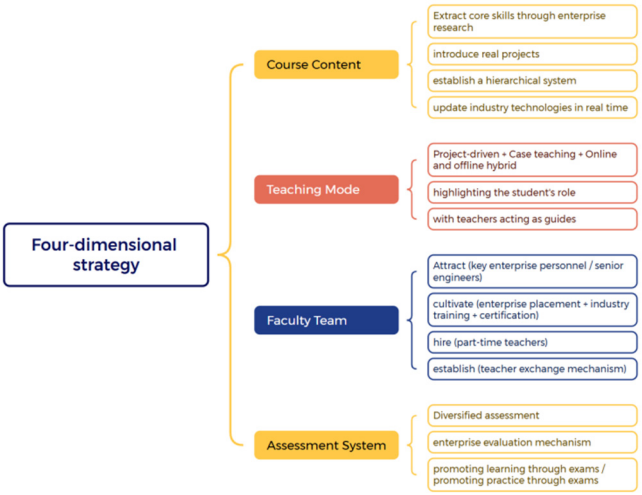



**Figure 1.** Four-dimensional correlation diagram

(1)Reconstruct Training Content to Accurately Align with Post Demands

Starting from enterprise post demands, the training content system is reconstructed in a planned and systematic way, which is conducive to the in-depth integration of "posts, courses, competitions and certificates". First, conduct systematic research on enterprises and industry associations, clarify the competence requirements of relevant posts in the field of network engineering (network engineer, operation and maintenance engineer, network security engineer, etc.), extract the core skill points of the posts, introduce real enterprise projects into the practical training course, and thus naturally and appropriately construct a hierarchical training content system of "basic module + core module + expansion module".

The basic module starts with the basic configuration of network equipment and the construction of network topology, enabling students to lay a solid theoretical foundation and master basic operational skills. Then, the core module is designed with real enterprise network engineering projects as the carrier, systematically and hierarchically introducing content such as network planning and design, equipment deployment, debugging and optimization, and fault troubleshooting, so as to fully cultivate students' engineering practical ability and systematic thinking. Furthermore, the expansion module integrates new industry technologies such as cloud computing, virtualization, network security and SDN, and designs practical and post-oriented training projects

combined with the assessment requirements of vocational skill certificates such as Huawei HCIA and Cisco CCNA, so as to comprehensively improve students' post competitiveness and innovative ability. More importantly, all training content is updated in a timely manner and closely aligned with the development trend of industry technologies.

(2) Innovate Teaching Model to Arouse Students' Initiative

To break the traditional teaching model of "teacher-led and student-passive", it is advisable to naturally and appropriately construct a teaching model of "project-driven + case-based teaching + online and offline blended teaching", and effectively highlight the subject status of students.

The project-driven teaching method is adopted to organize teaching, with real network engineering projects as the carrier. The training content is naturally and reasonably divided into several project tasks, and students are required to complete the planning, design, implementation, debugging and summary of the projects in groups, thus effectively cultivating students' engineering thinking, team spirit and problem-solving ability. In teaching, teachers act as guides and mentors, encouraging students to think actively, explore independently, try boldly and innovate courageously.

The introduction of case-based teaching method is arranged in a clear and appropriate way: first, select typical network engineering project cases of enterprises, analyze the project background, demand analysis, design ideas and implementation process layer by layer, so as to enable students to understand the actual work processes and technical application scenarios of enterprises in a natural and reasonable way and effectively improve their practical application ability. Then, an online teaching platform is built to systematically upload various resources such as training videos, operation guidelines, case materials and exercises. Offline classrooms organize various activities such as project operation, group discussion, and Q&A, so as to achieve the in-depth integration of online and offline teaching.

(3)Strengthen the Construction of Teaching Staff to Improve Practical Ability

The practical ability and teaching level of the teaching staff are improved in a systematic and hierarchical way by building a team of "double-qualified" teachers through various measures of "introduction, cultivation and employment". Specifically, first, introduce technical backbones and senior engineers of network engineering in the front line of enterprises as part-time teachers to undertake practical training teaching and project guidance, and naturally and reasonably integrate enterprise practical experience and the latest industry trends into classroom teaching.

Second, strengthen the cultivation of existing teachers in a systematic and planned way. First, formulate a teacher practical training plan, organize teachers to take on temporary positions in enterprises, participate in industry training and technical seminars, and enable teachers to directly participate in the design, implementation and operation and maintenance of real enterprise network engineering projects, thus fully accumulating practical experience. Meanwhile, actively support teachers to obtain relevant vocational skill certificates to effectively improve their professional competence. In addition, improve the teacher exchange mechanism to facilitate positive interaction, mutual learning and resource sharing between teachers and enterprise engineers as well as teachers from other universities.

(4)Optimize the Assessment System to Highlight the Competence Orientation

To break the traditional summative assessment model, it is necessary to proactively and plannedly establish a diversified assessment system of "process assessment + summative assessment + comprehensive quality evaluation", so as to naturally and appropriately evaluate students' practical ability, team cooperation ability and innovative awareness, and truly realize "promoting learning and practice through assessment".

**Table 1.** Comparison Table of Core Dimensions Before and After Curriculum Reform

| Reform Dimensions | Before Reform | After Reform |
|---|---|---|
| Practical Training Content | Theory verification-oriented, no hierarchical design, outdated technologies | Integration of Posts, Courses, Competitions and Certificates, three-tier system, post-oriented |
| Teaching Model | Teacher lecture + student imitation, offline-only mode | Project-driven + case-based teaching, online-offline blended mode |
| Teaching Staff | Academic-oriented teachers, lacking practical enterprise experience | Double-qualified teachers, integration of introduction, cultivation and employment, school-enterprise communication |
| Assessment System | Summative assessment-dominated, result-oriented, single evaluation dimension | Diversified assessment, process-oriented, incorporating enterprise evaluation |
| Students' Dominant Position | Weakened, passive knowledge acceptance | Highlighted, independent inquiry & team collaboration |
| Post Alignment Degree | Disconnected, disjunction between learning and application | Accurate alignment, high post adaptability |
| Cultivation of Engineering Competence | Scattered operational skills, lack of engineering thinking | Systematic engineering competence, with proficiency in troubleshooting & project design |
| Integration of Industrial Technologies | No introduction of new technologies, disconnected from the industry | Integration of cloud computing, SDN and other new technologies, keeping pace with industrial development trends |

Process assessment accounts for 60% of the total score, which is used to evaluate students' completion of each project in the training process, operational standardization, group cooperation performance, problem-solving ability and learning attitude. Therefore, a comprehensive evaluation should be conducted through classroom questioning, practical operation inspection, group reporting, training logs and other methods. Summative assessment accounts for 30%, aiming to evaluate students' comprehensive practical ability. Therefore, a complete network engineering project is naturally taken as the assessment carrier to directly examine students' abilities in project planning, design, implementation, debugging and summary. Comprehensive quality evaluation accounts for 10%, which assesses students in terms of innovative awareness, professional ethics and team spirit, with a comprehensive score based on training performance and teacher evaluation.

At the same time, with the introduction of the enterprise evaluation mechanism, enterprise engineers are invited to directly participate in the evaluation of students' practical training achievements, and make an objective and practical assessment of students' practical ability from the perspective of post requirements.

The table is divided into three columns: reform dimension, before reform, and after reform. It covers 8 core dimensions and forms a comparison as shown in Table 1.

# 4. Reform Practice and Effects

To verify the effectiveness of the reform plan, this paper takes the 2022-grade students majoring in network engineering of an application-oriented undergraduate university as the research object, applies the reform measures to the teaching of the course Network Engineering Project Training in a natural and appropriate way, and then makes a systematic analysis of students' practical ability, post adaptability and course evaluation based on the actual teaching of one semester.

(1)Thanks to the full implementation of the reform measures, students' practical ability has been significantly improved: after the reform, students have more opportunities to participate in real network engineering projects, thus being able to fully complete tasks such as network planning and design, equipment deployment, debugging and optimization, and fault troubleshooting, and their practical skills and engineering thinking have been greatly improved. Therefore, the completion rate of students' projects in the comprehensive practical training assessment at the end of the semester has increased to more than 90%. The number of students participating in national competitions such as the National College Student Information Security Competition and the National College Student Information Security and Countermeasure Technology Competition and their rankings have also been gradually improved.

(2)Since the teaching quality of the course has been fully recognized by students, teachers and enterprises, it can be naturally and appropriately concluded that the teaching quality of the course has been greatly improved after the reform: the satisfaction rate of students with the course has increased to more than 92%, who believe that the course content meets post needs, the teaching model is novel and can effectively improve practical ability; teachers believe that the reformed course teaching is more practical with a proper arrangement of teaching difficulty, thus being more conducive to achieving the goal of applied talent cultivation; enterprises also clearly affirm that graduates have strong practical ability and high post matching degree, and can quickly be competent for enterprise work..

# 5. Conclusion and Prospects

The reform of the course Network Engineering Project Training is an inevitable requirement of the goal of applied talent cultivation, and is obviously an extremely effective measure to improve the teaching quality of the network engineering major. Therefore, this paper systematically analyzes the existing problems of the course, such as the disconnection between training content and post demands, a single teaching model, weak practical competence of teaching staff, and an imperfect assessment system, and then puts forward clear and feasible reform plans from four dimensions: the reconstruction of course content, the innovation of teaching model, the construction of teaching staff, and the optimization of assessment system, which are fully verified by teaching practice. The reformed course has effectively improved students' engineering practical ability, post adaptability and innovative awareness, realizing the natural and appropriate alignment between course teaching and the goal of applied talent cultivation.

However, as course reform itself is a process of continuous optimization and progressive advancement, it is undeniable that there are still several obvious and important deficiencies in the current reform: first, the update of training equipment lags behind the development of industry technologies, so many new technology training projects cannot be carried out smoothly; second, school-enterprise cooperation is insufficient, and the enthusiasm of enterprises to participate in teaching has not been fully mobilized; third, the cultivation of students' innovative ability still needs to be strengthened, and many students lack the awareness and ability of active innovation.

In the future, it is necessary to promote course reform in a systematic and planned way, strengthen school-enterprise cooperation, jointly build practical training bases, and naturally and reasonably introduce real enterprise projects and the latest industry technologies into the training content. At the same time, increase investment in training equipment, improve the construction of practical training platforms, innovate teaching methods, and imperceptibly cultivate students' innovative ability, so as to effectively improve the teaching quality of the course and cultivate a large number of high-quality applied talents in network engineering for the society. More importantly, summarize the reform experience, form a replicable and promotable teaching reform model, and provide a reference for the reform of similar courses in application-oriented undergraduate universities.

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