

Leveraging Deep Learning for Enhanced Computer Network Teaching: A Research and Application Study

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Abstract: *With the introduction of new engineering disciplines, classroom teaching methods for computer-related majors have transitioned from traditional theoretical instruction to advanced pedagogical approaches that cultivate students' cognitive development. The emphasis lies in fostering students' higher-order thinking abilities, with the core teaching philosophy centered on improving hands-on competencies. This encompasses exercises in critical and creative thinking, which serve to enhance both cognitive and non-cognitive abilities. Effectively integrating deep learning with advanced classroom methodologies and applying them to comprehensive practical courses within new engineering disciplines—such as computer network courses—can strengthen students' capacity to solve complex problems through hands-on practice. For example, incorporating artificial intelligence (AI)-related technologies into the experimental content of network security classrooms and employing various virtualization technologies to construct network simulation platforms can validate the effectiveness of technological applications. These approaches fully stimulate students' interest in learning, enabling them to engage with practical course content through immersive learning experiences. Through graded and progressive experimental stages, students can systematically enhance their hands-on abilities. Effective course practice has demonstrated that this method not only facilitates more detailed instructional control for educators but also improves student classroom participation and exercises their practical skills, thereby fully enhancing the teaching quality of comprehensive practical training courses.*

Keywords: Deep learning; Advanced courses; Computer network; Professional comprehensive practice; Artificial intelligence.

1. INTRODUCTION

At the National Conference on Undergraduate Education in the New Era held by the Ministry of Education, it is necessary to fully implement General Secretary Xi Jinping's emphasis on cultivating innovative, versatile, and applied talents in universities, and to lead the reform of higher education with the construction of new engineering disciplines. The comprehensive practical courses that occupy a very important position in applied universities are also undergoing curriculum reform. Combining theoretical knowledge with engineering practice projects is the goal of new engineering majors such as computer science, and it is also the main teaching task of comprehensive practical courses. The overall idea is to enhance students' hands-on and project practice abilities, laying a solid foundation for their future employment and further studies. This article will focus on exploring the comprehensive practical courses of new engineering majors in network engineering, using advanced classrooms to improve teaching effectiveness, deepen students' practical abilities, provide good practical conditions and technical environment for students' deep learning in the professional direction, fully tap into students' strengths, and enhance their cognitive development. At the same time, through the careful design of practical activities by teachers, students' non cognitive abilities are fully reflected, and the improvement of comprehensive quality is put into practice. The main guiding principle of practical teaching design is "three-stage progression", which divides teaching into three stages of objectives. The low-level objectives focus on solving "knowledge ability", the mid-level objectives focus on solving "application ability", and the high-level objectives focus on solving "innovation ability". The entire practical course will be guided by the realization of students' creative thinking, incorporating deep learning ideas, tracking students' entire learning path and learning status, improving students' learning efficiency, achieving knowledge internalization and two-way growth of abilities, and enabling talent cultivation to leap from the stage of "mastering information" to the stage of "mastering knowledge", realizing the development of students' low-level thinking to high-level thinking and high-level abilities. The three-level progressive professional comprehensive practical teaching philosophy and objectives are shown in Figure 1 below:



Figure 1: Three stage progressive professional comprehensive practice teaching philosophy and objectives

Zhou[1] examined the hierarchical structure of customer needs in US automotive feedback, elucidating the sentiment–function nexus to better align product design with consumer expectations. Wensi[2] investigated AI-enabled data visualization strategies for automated production line marketing, demonstrating that intelligent visual analytics can enhance customer trust and improve lead-to-order conversion rates. Li[3] further contributed to industrial automation by optimizing AI-driven bid pricing models for non-standard projects, leveraging historical financial data and machine learning algorithms to increase pricing accuracy. In the domain of natural language processing, Ren[4] enhanced Seq2Seq models for role-oriented dialogue summarization through adaptive feature weighting and dynamic statistical conditioning, yielding more contextually coherent and informative summaries. Financial security and market prediction have seen significant progress through edge computing and graph-based approaches. Yang and Zhang[5] developed an edge-enabled real-time fraud detection system for network lending terminals under strict low-latency constraints, ensuring timely intervention without compromising detection accuracy. Zhao et al.[6] optimized hybrid deep learning models combining temporal convolutions, gated recurrent units, and self-attention mechanisms for dynamic market behavior prediction, validating their approach against statistical and neural forecasting baselines. Complementing this, Yang et al.[7] constructed multi-dimensional network credit-related transaction risk maps by integrating graph neural networks, enabling early warning capabilities and enhanced risk visualization. In photonic engineering, Tang et al.[8] focused on the design and optimization of shallow-angle grating couplers to achieve efficient vertical emission from indium phosphide devices, a critical advancement for integrated photonic circuits. User interaction and data representation were addressed by Sun[9], who proposed a machine learning framework for adaptive interfaces that personalizes user experiences based on behavioral patterns, and by Deng[10], who enhanced neural network performance on tabular data through knowledge distillation and RankGauss transformation, improving model robustness and training efficiency. In medical AI, Xu et al.[11] applied attention-based deep learning models to clinical natural language processing for multi-disease prediction, extracting diagnostic insights from unstructured patient records. Broader economic implications were explored by Chen et al.[12], who analyzed the green innovation effect of the digital economy, establishing a positive relationship between digitalization and environmental sustainability. In hydraulic engineering, Yao[13] conducted experimental research on local head loss coefficients in short-tube hydraulic testing, providing refined empirical parameters for fluid system design. Finally, Xiangyu et al.[14] developed a novel granule extrusion-based 3D printing method for polyolefin elastomer (POE), employing response surface methodology to investigate the effect of printing parameters on mechanical properties, thereby optimizing additive manufacturing processes for flexible materials.

2. CHARACTERISTICS AND TEACHING STATUS OF PROFESSIONAL COMPREHENSIVE PRACTICE COURSES

The rapid development of network technology has further increased the demand for automation and intelligent management of networks. The integration of new technologies such as SDN and AI has given rise to new intelligent network management and defense methods. This is bound to trigger a transformation in the comprehensive practical teaching content of network engineering majors. The analysis of professional comprehensive practice courses reveals the following characteristics:

2.1 Practical courses have strong operability

Unlike ordinary theoretical courses, professional comprehensive practical courses are project-based practical courses that students undertake based on the characteristics of their professional skills after completing professional theoretical courses. The professional comprehensive practice course is mainly project driven. Under the guidance of teachers, the practical process is similar to enterprise projects. Through centralized training and practical experience, students complete the project topic selection, network design, and experimental verification throughout the entire process. Teachers rarely provide theoretical explanations throughout the entire process. Professional comprehensive practical experience can effectively exercise the ability to connect theory with practice, solve practical problems with higher-order thinking, and accumulate professional practical experience in advance.

2.2 Late start of course

Professional comprehensive practical courses are generally offered in the second semester of the third year and the first semester of the fourth year. At this time, students have already completed theoretical courses, which is also the last course in their professional courses and has special significance and value.

2.3 High requirements for progress control

Professional practical courses usually only have one month of time, which is very tight. Students are required to complete requirement analysis, outline design, experimental verification and testing within the prescribed class hours, and finally complete the course paper. This requires teachers and students to scientifically arrange class hours, plan the schedule reasonably, and scientifically design courses at different stages.

2.4 High demand for student autonomy

The projects of professional comprehensive courses are jointly developed by teachers and enterprises, and students form teams to achieve project goals (with a team size of no more than 5 people). During the defense of professional comprehensive courses, the advantage projects are selected through competition to promote learning. This organizational method can give students higher autonomy, stimulate their learning enthusiasm, and unleash their enthusiasm, thereby improving the practical effectiveness of professional comprehensive courses.

At present, there are the following problems in the implementation of practical courses:

Due to the rapid updates of network equipment, a large number of practical courses will design and implement practical content on traditional network devices, making it difficult to update professional practical content.

At present, intelligent security defense technology pays more attention to the use and management of security devices. Practical courses should consider both emerging technologies and endogenous security. However, due to the integration of multiple technologies, there is a lack of technical depth in the design of practical content.

Due to limited class hours, there is a contradiction between the teaching objectives and the improvement of students' ability to solve complex problems, which affects the achievement of teaching objectives. At present, many professional comprehensive practice classrooms have consistently adopted methods such as Problem Based Learning (PBL), collaborative learning, project driven learning, and competition driven learning. However, these methods mainly emphasize student centeredness and weaken the role of teachers. In fact, in professional comprehensive practice classrooms, the role of teachers is more important than ever before. Teachers need to lead the implementation details of the entire teaching process like directors. If the teaching design is not in place, the classroom will not achieve good results.

3. CREATIVE COGNITIVE ABILITY CULTIVATION PLAN BASED ON ADVANCED CLASSROOM

In the current context of focusing on cultivating college students' innovation ability, it is urgent to carry out diversified teaching around the goal of deep learning for college students. The project-based advanced course teaching method has been recognized and valued by many educators. The depth of learning is no longer measured by the difficulty of the learning content, but by setting up an appropriate learning context based on project goals and students' personalized characteristics, ensuring that the practical content has a certain level of complexity and promoting the achievement of students' innovative abilities. Advanced classroom [4] is the construction of one or more project tasks to drive students' curiosity and thirst for knowledge, enabling them to actively learn and explore with specific task goals. Deep learning refers to a learning process in which students, guided by teachers, engage in wholehearted learning around challenging higher-order goals. Deep learning also prioritizes the cultivation of creative thinking, with stimulating students' independent thinking and judgment as important factors. In this process, students master the core knowledge of the subject, understand the learning process, grasp the essence and thinking methods of the subject, form positive and proactive learning motivation, and experience meaningful learning processes. The deep learning model based on advanced courses can fully stimulate students' exploratory consciousness, cultivate their deep participation ability, promote their deep understanding of knowledge, and ultimately cultivate their application and innovation abilities. The following figure shows the objectives of a practical teaching plan that integrates deep learning and higher-order thinking. The details are as follows: Yan Xixi et al. [6] used project-based teaching method and hierarchical goal teaching method to explore the arrangement of teaching content, the application of teaching methods, and designed project-based teaching content. They proposed a teaching mode suitable for new engineering majors, focusing more on cultivating students' creative thinking and problem-solving abilities.

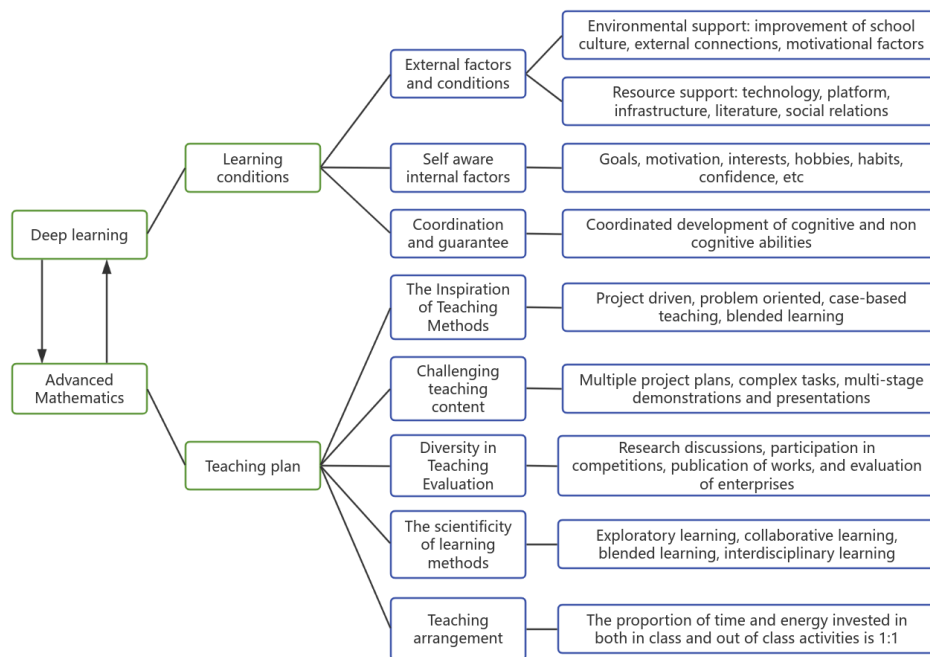


Figure 2: Objectives of the Practical Teaching Plan Integrating Deep Learning and Advanced Teaching

3.1 Effect and Evaluation

3.1.1 Design of teaching content

The use of easily deployable cloud experimental platforms for virtual network practical teaching is increasingly receiving attention from professional practical classrooms. By adopting a virtualization, multi fusion, and progressive experimental teaching content that integrates new technologies such as AI and SDN with professional basic knowledge, virtualization technology can be used to complete the construction, transmission, security

boundaries, terminal applications, and other aspects of network architecture. This can solve the problem of difficult implementation of network topology construction and control plane defense strategies in existing professional practice solutions, and enhance the ability to simulate and test network engineering problems. Using artificial intelligence methods to solve virtualization and progressive practical content, integrating knowledge from multiple fields such as SDN network topology construction and artificial intelligence algorithms with new technologies, and combining AI and SDN with professional basic knowledge to verify security defense strategies such as boundary protection, web applications, and intrusion detection. This effectively promotes students to think about applying new technologies to solve existing network problems, and stimulates their interest and enthusiasm for learning new technologies.

3.1.2 Organizational aspects of teaching methods

Based on the characteristics and teaching content of specialized courses, course tasks are classified and designed according to the project objectives of different stages and categories of specialized courses. The categories of practical teaching plans include algorithm practice, scheme discussion, project practice, and achievement reporting. Classroom designs of different categories have differences in form, and can be planned reasonably according to the hierarchical situation of students. Facilitating scientific planning of classroom time, teaching content is effectively divided according to the length of time, and each time period is planned by the teacher to achieve hierarchical progression of teaching content. Rewards and punishments are given to students at appropriate teaching nodes to stimulate their learning enthusiasm.

3.1.3 Design of Teaching Plan

This type of classroom needs to fully mobilize students' participation in technical solutions. Students will discuss the relevant technologies, protocols, and deep learning algorithms needed in professional practice courses based on project tasks. In the design of the comprehensive plan, the principle of progressive task objectives is followed, and the tasks are divided into three stages: basic, advanced, and innovative. The basic stage requires the ability to build an SDN network topology based on logical topology; The advanced stage requires the ability to call artificial intelligence algorithms based on defense requirements to achieve the security protection capabilities of SDN networks; The innovation stage requires deeper design and optimization based on one's own abilities and interests. The comprehensive project plan requires the application of knowledge from multiple fields, enabling students to improve their diverse knowledge, methods, and technical abilities, and enhance their overall ability to solve complex problems.

3.1.4 Evaluation of Teaching Achievements

The report of achievements is the final stage of professional comprehensive practical training, and also the final stage of professional comprehensive practical training. Students are required to report their achievements and defend their projects, and ultimately complete the teacher's course summary through grading. The achievement report is mainly motivated by the defense score, which guides students in preparing for project reports and is also an important basis for teacher evaluation. The defense scoring table should be suitable for all aspects of the project, including project completion quality, report format, and problem-solving. The evaluation method of the project results can enable students to have a deeper understanding of professional knowledge. By jointly developing project report materials and sharing project results, students can effectively enhance their non cognitive abilities and improve their interest in professional learning. Teachers and students can grow together in this process.

The professional comprehensive practical training course based on the innovative ability cultivation mode has enhanced students' learning motivation, stimulated their enthusiasm and initiative for learning through course teaching reform. After multiple discussions and reforms by teachers in the teaching and research group, there are several outstanding aspects of advanced classroom teaching activities based on deep learning:

(1) Task Design:

By refining, refining, and intricately designing the practical content of the three stages, we aim to stimulate students' interest in deep learning, awaken their desire to learn, fully engage in hands-on practice, and truly participate in course projects;

(2) Teaching process:

Students strictly follow the teaching mode of "design analysis improvement" to continuously optimize the teaching process, and teachers cooperate to guide difficult knowledge and key processes, so that students' innovation ability can spiral upwards;

(3) Teaching method:

Adopting diverse teaching methods such as advanced courses, group competitions, and flipped micro courses to cultivate students' deep learning abilities, enabling them to develop rich learning interests and enhance their ability to solve complex problems during the learning process;

(4) Course Reflection:

Teachers focus on cultivating students' reflective awareness, reflective ability, and reflective habits in the curriculum, guiding students to reflect after stage exercises and project reports, and improving students' knowledge and skills reserves and higher-order thinking qualities.

(5) Course achievements:

Through multiple progressive stages of professional comprehensive training courses, students can effectively improve their professional abilities and innovative qualities. The number of people participating in technology innovation competitions in the field of network engineering has been increasing year by year, and the types of competitions have also become increasingly diverse, which indicates that the cultivation of students' innovation ability has been effectively improved.

The curriculum reform guided by the cultivation of innovative abilities has fully reflected the teaching effectiveness of advanced classrooms, and the virtual simulation experiment platform has provided technical support for teaching reform. Advanced courses based on deep learning can fully mobilize the enthusiasm of teachers and students in the teaching process, further improving the teaching quality and effectiveness of practical courses in new engineering majors.

4. CONCLUSION

In recent years, application-oriented universities have been constantly exploring new methods to cultivate new engineering talents, and have been continuously reforming their courses to meet the needs of the times and society, with a particular focus on professional practical courses. These courses have strong applicability and are guided by the development of innovative abilities. In terms of optimizing the teaching mode, our college mainly uses high-level classrooms to improve the feedback mechanism of the teaching process, comprehensively formulates project tasks, breaks down the barriers between theory and practice, links professional comprehensive training with graduation projects, awakens students' learning motivation, organically integrates new technologies with virtualization practice platforms, and stimulates students' interest in exploration. Optimize the teaching mode by adopting a project task driven approach. Enable students to closely focus on the high-level task objectives of the project, use multi-stage objectives to assess and provide feedback on project tasks, and continuously improve and optimize them. The implementation of deep learning in this course system for professional comprehensive training starts from cultivating students' hands-on and practical abilities, integrating task driven and deep learning methods into the project design and teaching process of professional comprehensive practice, effectively improving the problem of one lesson one practice in traditional training courses, achieving a fundamental transformation from knowledge imparting to innovation ability cultivation, and having strong practicality.

REFERENCES

- [1] Zhou, Z. (2026). Hierarchical Needs in US Automotive Customer Feedback and the Sentiment–Function Nexus. *Journal of Industrial Engineering and Applied Science*, 4(1), 27-33.
- [2] Wensi, L. (2026). AI-Enabled Data Visualization Marketing for Automated Production Lines: Building Customer Trust and Improving Lead-to-Order Conversion. *Academic Journal of Natural Science*, 3(1), 8-13.
- [3] Li, W. (2026). Optimizing AI-Driven Bid Pricing Models for Non-Standard Automation Projects: Leveraging Historical Financial Data and Machine Learning Algorithms.

- [4] Z. Ren, "Enhancing Seq2Seq Models for Role-Oriented Dialogue Summary Generation Through Adaptive Feature Weighting and Dynamic Statistical Conditioning," 2024 6th International Conference on Communications, Information System and Computer Engineering (CISCE), Guangzhou, China, 2024, pp. 497-501, doi: 10.1109/CISCE62493.2024.10653360.
- [5] Yang, X., & Zhang, Y. (2026). Edge-Enabled Real-Time Fraud Detection for Network Lending Terminals under Low-Latency Constraints. *Journal of Computer Technology and Applied Mathematics*, 3(1), 55-62.
- [6] Zhao, S., Lin, Y., Yang, X., Lu, Q., Xue, H., & Jiang, G. (2025). Optimization of Deep Learning Models for Dynamic Market Behavior Prediction. arXiv preprint arXiv:2511.19090.
- [7] Yang, X., Zheng, X., & Lu, Q. (2025, October). Construction and early warning of multi-dimensional network credit-related transaction risk maps by integrating graph neural network (GNN). In *Proceedings of the 2025 2nd International Conference on Digital Economy and Computer Science* (pp. 919-923).
- [8] Tang, Yingheng, et al. "Design and Optimization of Shallow-Angle Grating Coupler for Vertical Emission from Indium Phosphide Devices." (2020).
- [9] Sun, L. (2025, November). Adaptive Interfaces for Personalized User Experience: A Machine Learning Approach. In *Proceedings of the 2025 International Conference on Artificial Intelligence and Sustainable Development* (pp. 457-462).
- [10] Deng, Xiaoxiao. "Enhancing Neural Network Performance on Tabular Data via Knowledge Distillation and RankGauss Transformation." 2025 6th International Conference on Big Data & Artificial Intelligence & Software Engineering (ICBASE). IEEE, 2025.
- [11] Xu, Ting, et al. "Clinical NLP with attention-based deep learning for multi-disease prediction." 2025 4th International Conference on Robotics, Artificial Intelligence and Intelligent Control (RAIIC). IEEE, 2025.
- [12] Chen, K., Zhao, S., Jiang, G., He, Y., & Li, H. (2025). The Green Innovation Effect of the Digital Economy. *International Review of Economics & Finance*, 103970.
- [13] Yao, T. (2024, August). Research on the Local Head Loss Coefficient in Short-Tube Hydraulic Testing. In *2024 3rd International Conference on Applied Mechanics and Engineering Structures (AMES 2024)* (pp. 89-97). Atlantis Press.
- [14] Xiangyu, G., Yao, T., Gao, F., Chen, Y., Jian, X., & Ma, H. (2024). A new granule extrusion-based for 3D printing of POE: studying the effect of printing parameters on mechanical properties with "response surface methodology". *Iranian Polymer Journal*, 1-12.