Exploration of Project Driven Practical Ability Cultivation for Electronic Information Talents

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Abstract. In order to adapt to the national development strategy in the field of electronic information science and meet the current social requirements for practical abilities of electronic information talents, practical and exploratory training of project driven practical abilities for electronic information talents has been carried out. Through three forms of student training in enterprise training bases, joint research studios established by enterprises in schools, and crosswise projects of school-enterprise cooperation, undergraduate and graduate students are allowed to participate in practical projects of enterprises, solve production needs of enterprises, develop new products, greatly improve students' hands-on practical ability, innovation ability, teamwork ability, communication ability, and organizational management ability. The training effect has been tested through achievement transformation, product participation in competitions, etc. The project driven cultivation of practical abilities for electronic information talents not only solves the problem of students' theoretical and practical disconnection, and their difficulty in adapting to social needs, but also to some extent solves the problem of insufficient funding for practical ability cultivation, providing a solution for the teaching and research work of high-level talent cultivation in energy and power digitization.

Keywords: Project-driven, Practical Ability Cultivation, Electronic Information Talents.

1 Introduction

The rapid development of the electronic information industry has put forward higher requirements for electronic information talents. Electronic information talents not only need to possess solid theoretical knowledge, but also strong practical abilities to adapt to constantly changing technological demands and industry development trends[1]. However, traditional education models often focus too much on theoretical teaching and neglect the cultivation of practical abilities, resulting in students being unable to meet job requirements in practical work[2]. At present, students majoring in electronic information mainly complete their practical work through course experiments, course

R. Koul et al. (eds.), *Proceedings of the 2nd International Conference on Educational Development and Social Sciences (EDSS 2025)*, Advances in Social Science, Education and Humanities Research 924,
https://doi.org/10.2991/978-2-38476-400-6_41

design, and various types of social practices, but they have obvious shortcomings as follows.

(1)Course experiments are usually divided into three levels: basic experiments, improvement experiments, and research and innovation experiments. The common feature of these three types of experiments is that they consolidate and expand the technical knowledge learned in the classroom through experiments, without being tested by real environments and scenarios.

(2)The course design mainly assesses students' mastery of the entire course. It requires students to construct a virtual system and background based on their own understanding and experience, sort out and summarize the course according to the teaching context, and write a report that deviates significantly from the technical report of a real system analyst.

(3) Social practice includes several forms such as cognitive internships, social surveys, graduation internships, and theses. These practical methods are somewhat close to the actual situation of enterprises, but to a considerable extent, they remain at a superficial level and lack participation and penetration in the actual informationization construction of enterprises.

However, the vast majority of practical activities driven by actual projects remain in the field of engineering, and there are hardly any that are truly used for undergraduate teaching as a talent cultivation field. Even if there are, they are not recognized by the mainstream teaching model of college style teaching. Projects are often completed by research teams from universities through delegation, which has legal binding force on the behavior of team members. Each member must participate in the informationization construction of the enterprise with a sense of ownership to ensure the regular completion of tasks[3]. This is of great significance for cultivating students' professional awareness, sense of responsibility, and job competency.

The majors of electronic information in North China Electric Power University takes the growth and development of students as the starting point, implements tasks from the aspects of profession, curriculum, and teachers, and has initially formed a distinctive feature of "focusing on the forefront of the discipline, based on electricity, serving society, and moving towards internationalization", making important contributions to the telecommunications, power industry, and local development. However, in the implementation process, there are also the above-mentioned problems, and even due to limited funding, the cultivation of students' practical abilities cannot meet expectations. In order to make up for this deficiency, the project driven teaching model has emerged. This paper will explore project driven strategies for cultivating practical abilities of electronic information talents and analyze their implementation effects.

2 The Connotation and Advantages of Project Driven Teaching Mode

Project driven teaching mode is a teaching mode that focuses on projects, students as the main body, and teachers as guidance. In this mode, students need to independently or collaboratively complete the analysis, design, implementation, and evaluation of projects under the guidance of teachers and based on project requirements, using their learned knowledge and skills. The project driven teaching mode emphasizes students' active participation and practical operation, focusing on cultivating students' innovative thinking, teamwork ability, and problem-solving ability. Consistent with the requirements for professional certification[4], this training model has significant advantages.

(1) In terms of improving practical abilities, students are able to apply the theoretical knowledge they have learned to solve practical problems during the completion of projects, thereby deepening their understanding and mastery of knowledge and enhancing their practical abilities.

(2) In terms of cultivating innovative thinking, the project driven teaching model encourages students to use innovative thinking, propose new solutions and methods, and cultivate innovative awareness and abilities during project implementation.

(3) In terms of enhancing team cooperation awareness, project driven teaching mode usually adopts the method of group cooperation, where students need to divide their work and cooperate within the group to jointly complete the tasks of each stage of the project, thereby enhancing team cooperation awareness and ability.

(4) In terms of improving overall quality, the project-based teaching model focuses on cultivating students' comprehensive qualities, including professional competence, communication skills, time management skills, self-learning abilities, etc.

3 Project Driven Strategies for Cultivating Practical Abilities of Electronic Information Talents

3.1 Project Selection and Design

Diversification of Project Sources. Projects should come from actual electronic information industry needs, including enterprise commissioned projects, self-developed projects, joint research projects, etc., providing students with rich practical opportunities. Students can enter school-enterprise joint training bases or joint research studios established by enterprises in schools, or participate in crosswise projects of school enterprise cooperation. Taking the self-developed project "Autonomous Controllable Feedline Automation Terminal" of Baoding Jinneng Electric Power Automation Equipment Co., Ltd. as an example, this project is based on the requirements of the State Grid for FTU domestic independent controllability. The project involves the localization replacement and upgrading of hardware platforms, software platforms, and all peripheral hardware components. It is the most complex and difficult research and development project of the company in the past five years.

The Comprehensiveness of the Project Content. The project content covers multiple knowledge areas and skill points in the field of electronic information, and can comprehensively apply the professional knowledge and skills learned by students. Taking the "Autonomous Controllable Feedline Automation Terminal" project as an example, the content covers various aspects of development work such as hardware chip selection, circuit principle design, and embedded system software programming implementation. The key technologies involved are: hardware selection and circuit design of domestic high-end MCUs (it is necessary to determine whether the core architecture is ARM or RISVC architecture); driver design for domestic MCU; selection of embedded operating systems (requires selecting an open-source and controllable operating system from among numerous open-source operating systems); research on autonomous and controllable software protection algorithms; product implementation that combines hardware and software platforms.

Moderate Difficulty of the Project. Subtasks with moderate difficulty can be selected from the project tasks, which can stimulate students' learning interest and desire for challenges, while not exceeding their knowledge and ability range. Taking the "Autonomous and Controllable Feeder Automation Terminal" project as an example, students can choose hardware development or software development based on their own foundation and interests, or choose tasks for software and hardware joint debugging. Each task is relatively independent and can be completed within the predetermined time.

3.2 Organization and Implementation of Teaching Process

Project Initiation. Teachers clarify the project background, objectives, requirements, and expected outcomes, guide students in conducting project requirement analysis, and organize students to form and divide project teams. According to the project proposal of the enterprise's self-developed project "Autonomous Controllable Feedline Automation Terminal", five undergraduate students participating in the project were assigned tasks, including MCU development, embedded development, analog-to-digital conversion, operating system, document writing, etc., and further explained the content and the connection between tasks.

Project Implementation. Students carry out specific work according to project requirements and plans, teachers provide technical support and assistance, and encourage students to learn and explore independently[5]. In the "Autonomous Controllable Feedline Automation Terminal" project, according to the new selection, software personnel need to choose and even learn to use R&D debugging tools, integrated compilation environments, etc. based on the new hardware platform. Need to learn how to use the BSP (Board Support Package) driver functions and various peripherals of the new hardware. For software platforms, according to the requirement of autonomy and controllability, it is necessary to choose from various open source operating systems such as RT thread, Threadx, FreeRTOS, etc. (commercial ones are not currently considered as the cost is too high). All existing programs need to be re ported and adapted. If the file system and Ethernet protocol stack are all re selected, there will be a lot of porting and adaptation work.

Project Evaluation. Teachers organize students to evaluate and summarize the completion status of the project, including pre project and post project evaluations. Before the project, project risks should be assessed to ensure a clear understanding, while post project evaluations summarize lessons learned and clarify further optimization directions. In the "Autonomous Controllable Feeder Automation Terminal" project, in terms of software and hardware joint debugging, because both the hardware platform and software platform are new and have not been used by anyone, when problems arise, it is difficult to pinpoint which aspect of the problem is in the initial stage, which will increase the research and development cycle to a certain extent. Especially in standardized programming, existing relatively stable code is completely scrambled and rewritten, which increases the risk. In terms of structural adaptation, based on the existing PCB circuit board and external structure, only component replacement changes are made. During the actual selection and design process, there is a risk of modification as it is uncertain whether the circuit board and structure fully meet the design requirements. In terms of product series, the company currently has multiple series of products, some of which are MCU on the motherboard and some on the core board. The newly selected minimum system requires multiple changes and adaptations in the future, which may not necessarily achieve seamless replacement. It is highly likely that corresponding design upgrades will need to be made based on multiple products in the future.

3.3 Integration and Optimization of Teaching Resources

Construction of Teaching Staff. Implement a dual mentorship system between schools and enterprises, with one teacher having a background and practical experience in the enterprise and the other being a school teacher. If conditions permit, further implementation of a "mentor group" guidance will be provided, consisting of 3-5 school enterprise experts. The mentor group is responsible for overseeing key stages such as proposal opening, mid-term inspection, and conclusion.

Construction of ExperimEntal Training Platform. Improve experimental equipment and facilities, establish electronic circuit design laboratories, communication system laboratories, etc., and cooperate with enterprises to jointly build training bases. North China Electric Power University has partnered with Baoding Jinneng Electric Power Automation Equipment Co., Ltd. to establish a training base. The company's FTU will be used as training equipment, which can be decomposed, displayed, experimented, expanded, developed, and equipped with testing fixtures.

Introduction of Enterprise Resources. Enterprises provide practical project requirements, technical support, internship opportunities, etc., participate in project guidance and evaluation, and provide practical platforms and employment opportunities for students. For software and hardware developed by students that the school does not have the conditions for development and testing, and require on-site debugging, students can take them to the enterprise to complete.

3.4 Establishment of Teaching Evaluation System

Evaluation criteria cover project completion, technical indicators, innovation, practicality, teamwork, communication skills, time management, and other aspects. In addition to internal evaluation, product marketing, achievement transformation, and competition awards are also manifestations of students' practical ability and level. Evaluation subjects include teachers, students, enterprise experts, and other multiple parties, comprehensively and objectively evaluating students' project practice abilities.

3.5 Effect

Significant results have been achieved through the implementation of a project driven strategy for cultivating practical abilities in electronic information talent. In the 18th "Challenge Cup" National College Students' Extracurricular Academic and Technological Works Competition in 2023, the project-based work "5G Smart Grid Simulation Based on HTML5+JS" won the special prize. In the Key Information Technology Track of the 2nd Energy Electronics Industry Innovation Competition in 2024, the project based work "Ultra high Voltage Overhead Transmission Line Live Defect Elimination Operation Robot" won the first prize in the Innovation Product category. "Autonomous Controllable Feedline Automation Terminal" and "Distribution Network Fault Location System Based on Traveling Wave Distance Measurement" from Baoding Jinneng have been selected for the College Student Innovation Training Program. Through the development of embedded software and hardware products, the students' abilities have been significantly improved. Graduate students who entered the Daban Power Generation Joint Training Base participated in the "Daban Power Generation Company Power Plant Data Exchange Standard Research" and "Daban Power Generation Company Data Resource Top level Design Research Project", completed the development of enterprise data models and data exchange standards, developed a power plant data fusion and data management service platform, and students who entered the station graduated with "excellent" grades. Undergraduates and graduate students who participated in more than 20 crosswise projects have significantly improved their practical ability. They can skillfully use the knowledge they have learned to solve practical problems and complete complex project tasks. Students' innovative thinking has been cultivated, can propose novel solutions and methods, design innovative project results, and at the same time have written and published papers[6,7], participated in international conferences and other activities. Students' sense of teamwork has been enhanced, and can effectively communicate, coordinate and collaborate with others to jointly complete project tasks. The comprehensive quality of students has also been improved, including professional competence, communication skills, time management skills, self-learning abilities, etc., laying a solid foundation for future career development. Four students who participated in the project practice have received national scholarships in the past two years, two have obtained the qualification for joint master's and doctoral studies, and one has been awarded the title of Outstanding Graduate in Hebei Province. They have also been welcomed by employers, in terms of employment, achieving 100% employment.

4 Conclusion

Project driven training of practical abilities for electronic information talents is an effective teaching model that can meet the requirements of the modern electronic information industry for talent practical abilities, adapt to the development strategy of the national electronic information science field, seize the opportunities of energy and power transformation, meet the current social demand for talents in the cross integration of electronic information and energy and power, and continuously promote the cultivation of high-level talents in the digitalization of energy and power. By carefully selecting and designing projects, organizing and implementing teaching processes reasonably, integrating and optimizing teaching resources, and establishing a scientific evaluation system, students' practical abilities, innovative thinking, and teamwork spirit can be effectively cultivated, and their comprehensive quality can be improved. Universities should further promote and improve project-based teaching models, strengthen cooperation with enterprises, and cultivate more outstanding practical talents for the electronic information industry[8].

Acknowledgments

This work has been partially funded by Hebei Provincial Postgraduate Education and Teaching Reform Research Project “Cultivation of high-level cross-innovation talents for the new power system of power Internet of Things” YJG2023125, Hebei Province Higher Education Teaching Reform Research and Practice Project 2022GJJG405, 2023GJJG415,2023GJJG416, 2024 North China Electric Power University Teaching Research and Reform General Project " Research of Project Driven Practical Ability Cultivation for Electronic Information Talents ".

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