

Exploration and Practice of Teaching Research and Reform on Echelon-Based Applied Talent Cultivation in the View of Industry-Education Integration

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Abstract—This research examines the hierarchical talent cultivation mechanism at Chengdu Jincheng College under the framework of industry-education integration. The study is designed to achieve four primary value-added goals: enhancing the growth of students, faculty, the institution, and industry partners. To meet these objectives, the college implements a project-driven teaching model, engaging alumni enterprises to form talent echelons, which include students from freshman to senior years. Horizontal projects are used as entry points to reinforce project-based learning and foster the development of non-cognitive skills. Additionally, the construction of vertical project capabilities helps students build practical application skills over time. This comprehensive approach integrates real-world industry demands with academic learning, ensuring that students are better prepared for professional careers. By aligning academic outcomes with enterprise needs, the research provides a robust model for cultivating talent, benefiting students, faculty, the institution, and its industry partners. This framework advances the practice of hierarchical talent cultivation within the context of industry-education collaboration.

Keywords—hierarchical training, four value-added aspects, project-driven, industry-education integration

I. INTRODUCTION

Currently, employment in China is facing an unprecedented complex situation. In 2023, the number of college graduates reached a record high of 10.76 million, but there is a severe mismatch between the supply and demand of job opportunities in the market. Some key industries, such as real estate, education and training, and the internet, have experienced downsizing, lukewarm recruitment, and layoffs, leading to a continuous decrease in employment opportunities. At the same time, there is also a mismatch between the quality of labor and the demands of different industries, resulting in structural employment problems. Many graduates struggle to find

suitable jobs, and many companies face difficulties in recruitment. In the face of such employment conditions, relying solely on government and social support and assistance is not enough. Graduates and universities themselves need to rely on improving their knowledge structure and innovative training models [1] to adapt to the current severe employment situation.

Based on this, the construction of a new type of applied talent cultivation model has become an urgent task in the field of higher education. It is necessary to construct a clear education chain – “industry – Sector – major – professional direction – employment position” to meet the needs of society and ensure that graduates have comprehensive overall qualities and strong professional abilities in the highly competitive workplace. However, there are also some pressing issues that need to be addressed in the process of cultivating graduates’ innovation and comprehensive practical abilities.

II. EXPLORATION OF ECHELON TRAINING FOR COLLEGE STUDENTS AND PROBLEMS ENCOUNTERED IN THE PROCESS

Take Chengdu Jincheng College’s Computer and Software School as an example: In order to better train students according to the demands of enterprise positions, the school has established 13 professional directions for students to independently choose from, based on their different majors. The team of professional teachers comprehensively cultivates students’ knowledge, abilities, and overall qualities in all aspects of this professional direction and guides them in internships and employment. The college carries out five ways of school-enterprise cooperation in talent cultivation:

- (1) Cultivation of professional directions classified and docked according to the demands of enterprise positions;
- (2) Customized directional cooperation cultivation tailored to specific talent demands of enterprises;
- (3) Package cooperation cultivation of “project + talent” entrusted by enterprises;

- (4) Cooperation cultivation of virtual company entrepreneurship platform;
- (5) Production-education-research integration echelon-based talent cultivation.

During the cultivation process, teachers introduce real projects or simulated projects into the classroom. Through different project tasks assigned to each group, the goal is to achieve comprehensive analysis and problem-solving abilities. However, the problem is that students cannot complete the project in one semester. After all, before officially starting the project, the teacher team needs to provide various training and learning tasks for students, followed by their practical phase. This leads to the situation that students are about to intern or graduate just at the beginning or halfway of the project, and the quality and progress of the project are not guaranteed, resulting in great problems in project delivery.

To address this issue and hope to cultivate a group of students with strong practical abilities and high overall qualities through project-driven approaches, the research team formed a professional guidance team (team members are full-time teachers with industry experience) and recruited senior students who have strong comprehensive learning abilities to join the project team as echelon members. A performance management system, assessment system, and monthly payment method were introduced to motivate students' enthusiasm and consciousness during this process, making full use of their spare time to promote their ability enhancement. After a period of practice, several issues were still found:

- (1) Although echelon members have been set up, true echelon management has not been implemented, resulting in low student learning enthusiasm and high management costs;
- (2) Apart from leading projects, teacher teams also have teaching and research tasks that interfere, making it difficult for teachers to fully devote themselves as the core management force of the team;
- (3) In the later stages of projects, there are various problems such as difficulty in project maintenance and quality assurance.

To solve these problems, a new mode of comprehensive practical ability cultivation for college students must be sought. This article explores a new mode based on my own experience and proposes a "new model of echelon-based applied talent cultivation under the perspective of integration between production and education". Through continuous improvement and innovation and practical application, significant results have been achieved.

III. NEW MODEL OF ECHELON-BASED APPLIED TALENT CULTIVATION AND TEAM-BASED GUIDANCE UNDER THE PERSPECTIVE OF INTEGRATION BETWEEN PRODUCTION AND EDUCATION

The concept of echelon-based training is not a new term. The idea of echelon-based talent cultivation can be traced back to the early 20th century industrialization era when enterprises began to recognize the importance of employee training and development for organizational success.

Against this background, organizations started to attach more importance to employee training and development to improve production efficiency and organizational performance. In the latter half of the 20th century, human resource management gradually became an important area in enterprise management, and the concept of echelon-based talent cultivation was gradually recognized at that time.

Echelon-based training is an innovative practical activity. Its core idea is to have upper-year students guide lower-year students through cross-grade collaboration within student teams. For example, senior students guide junior students, junior students guide sophomore students, and so on. This model fully utilizes the knowledge and experience of students across different grades within the team. In the process of guiding and helping each other, it not only enhances the practical abilities of lower-year students but also strengthens the guidance abilities and teamwork skills of upper-year students [2]. The establishment of a ladder-type training mechanism aims to cultivate high-quality elite talent; enhance horizontal and vertical research capabilities to strengthen students' independent thinking and problem-solving abilities in practice; and strengthen integration between production and education to ensure the effectiveness of applied talent cultivation. To better organize teams, enhance student motivation, strengthen project quality assurance, and ensure a win-win situation for both enterprises and universities, the teacher team has deeply reflected on and positioned team guidance methods and developed a set of feasible guidance plans. As present in Fig. 1 below:

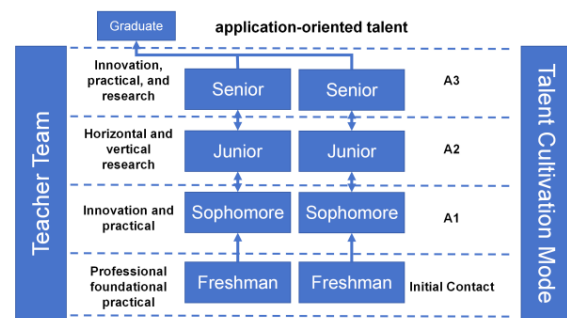


Fig. 1. Talent cultivation mode of hierarchical application in the perspective of industry-education integration.

A. Introducing Student Affairs Teachers to Compensate for the Management Deficiencies of Full-Time Teachers

The guidance team for students is composed entirely of full-time teachers, which inevitably leads to interference from teaching, research, and family affairs, resulting in deficiencies in the psychological construction and substantive management of students. To address this issue, student affairs teachers are invited to join the team, primarily responsible for organizing interviews, recommending students, obtaining mutual recognition between enterprises and teams, and evaluating the reasonableness of students' after-school time at all grade levels. Full-time teachers are mainly responsible for regularly training students and promoting projects

(assigning inspection tasks). Through division of labor and cooperation, it can greatly reduce the pressure on full-time teachers in terms of student management and organization, focusing on student cultivation and project promotion.

B. Clear “Responsibility, Right, and Interest”, Improve the Assessment System

1) Teacher responsibilities

Guidance teachers are responsible for developing a monthly training plan that needs to be detailed to the weekly level, including weekly goals, learning content, and requirements. For example, a complete training plan from basic entry to familiarity with project code, modification of code to independent development. The training plan is reviewed by the team leader, and a summary of the implementation of the training plan is made each week. Guidance teachers need to provide timely answers and guidance to newcomers’ learning problems, check and evaluate the achievement of newcomers’ learning goals every week.

2) Clear student growth path

Team managers will record attendance, learning status, project task completion status, etc. for team members, forming regular assessment data. The assessment results will be divided into three levels:

A1 level: Can serve as the backbone of the project, independently responsible for customer communication/requirement analysis/system design/development/testing duties. Eligible for company internships and using company projects to participate in graduation thesis writing, subsidies can be issued according to projects/cycles.

A2 level: Can independently undertake corresponding project tasks. Can participate in core document writing of the project, such as test cases, test reports, development documents, database documents, requirements documents, and software copyright materials; can undertake project design/development/testing work, complete tasks on time and with quality, and enjoy corresponding subsidies based on project effectiveness.

A3 level: New team members in the learning period. Can participate in operation manual writing, video recording, and other project-related work: data entry, data collation, software copyright materials; undertake general project tasks: simple front-end and back-end code work, simple testing work. Can participate in team training, and those who perform well in monthly assessments will receive gifts as rewards.

3) Improve the assessment mechanism and level entry/exit rules

The echelon training mode can maximize the non-cognitive abilities of students, enabling them to have a sense of teamwork, responsibility, and urgency, truly making students enrich with their studies in school. In the echelon management mode, while students enjoy corresponding rights and benefits in the team, the level assessment also needs to be improved to form a positive learning attitude.

A3 level: Students who pass the recommendation and interview successfully. If they fail the monthly assessment

due to time/energy/attitude not being able to ensure task completion, they will leave the team.

A2 level: Newcomers who have passed the training phase (1–3 months) and have the ability to undertake project tasks will enter this level. If the monthly assessment of students at this level is not passed, and their time/energy/attitude cannot guarantee the completion of the task, it will be demonstrated that they have not met the relevant competencies required for A2 level, and they will be returned to A3 level.

A1 level: Participants who have completed the A2 stage (1–3 months) and have actively engaged in 3–5 projects, with a consistent record of excellent monthly assessments for three consecutive months, will be promoted to this level. If a participant fails to pass the monthly assessment, it indicates that they have not yet met the required competencies for A1, and they will be reverted to the A2 level.

C. Newcomer Learning and Sharing

In conjunction with the training plan, regular knowledge training is conducted twice a week, with participation from all newcomers. It is required that weekly learning summaries be output in document form and shared at a fixed time. Team management personnel are responsible for collecting and summarizing, organizing and coordinating sharing time, content, and location, and notifying all members in advance. The guidance teacher and team leader check and comment on the learning summary, pointing out the strengths and weaknesses and providing improvement suggestions. The team leader conducts monthly assessments with the guidance teacher to evaluate the performance of newcomers. Those who perform well are rewarded during the monthly summary; for those who perform poorly, the team leader communicates with them and gives them a two-week observation period. If they are still unable to perform their duties, they will leave the project team.

D. Regular Team Building Interactions

In order to better understand each other, build trust, and enhance team cohesion, the team regularly organizes team activities such as team sharing and reflection meetings, workshops and trainings, team games and competitions, team outreach activities, etc., to strengthen interactions and relationships among team members.

IV. EFFECTS AND ANALYSIS OF A NEW PRACTICE MODEL FOR HIERARCHICAL APPLICATION TALENT TRAINING UNDER THE PERSPECTIVE OF INDUSTRY-EDUCATION INTEGRATION

Through two years of practice, the research team has basically formed a relatively complete hierarchical talent training system and a positive team culture. In the hierarchical training model system, senior students serve as mentors for junior students, while junior students act as guides for freshmen and establish mentor-apprentice relationships at each level [3]. Through project practice, the following significant achievements have been realized:

A. *Utilizing School-Enterprise Projects to Promote Learning through Competitions, Teaching through Competitions, Research through Competitions, Achieving Four Value-Added Aspects*

Through the establishment of an echelon-based training mechanism, students receive comprehensive enterprise-style training in projects, enabling seamless transition upon employment and completing the transformation into elite talent, achieving student value-added. Teachers can apply their guiding practice in student team project processes back to classroom theory, while also enhancing their own horizontal and vertical research capabilities. Based on horizontal projects, vertical research topics can be applied for, providing opportunities to become subject review experts and achieving teacher value-added. School-enterprise collaboration projects can provide enterprises with talent and innovative resources, helping improve competitiveness and sustainable development. At the same time, they also provide schools with funding, practical opportunities, and knowledge exchange opportunities, contributing to improving the quality of education and research and achieving mutual value-added and win-win outcomes for both schools and enterprises [4].

B. *Building Strong Team Cohesion through Team Building Activities*

Practice has proven that team building activities help reduce barriers between team members and establish deeper levels of trust; they enhance the morale and job satisfaction of student team members. These activities also encourage members to think creatively about innovative methods and solutions, especially when facing challenging problems or obstacles [5]. Through organizing team activities, teachers have the opportunity to observe the leadership potential and team roles of each member, better understanding their abilities and potential, thus assigning tasks and responsibilities more effectively.

C. *Relying on School-Enterprise Projects to Promote Learning through Competitions and Employment through Learning*

In the past two years, the team has successfully delivered multiple horizontal projects such as software development for digital twin smart parks, voiceprint detection, smart spaces, and smart badges, receiving unanimous praise from partner organizations. While participating in these projects, students can form teams to participate in various national-level A-class competitions, such as Internet+, C4-Network Technology Challenge, Challenge Cup, and China National Undergraduate "Innovation, Creativity and Entrepreneurship" Challenge. In 2023, the team achieved remarkable results in competitions, winning one second prize at the C4-Network Technology Challenge Competition, one second prize at the Southwest Regional Competition, two second prizes at the National College Students' E-commerce "Innovation, Creativity, and Entrepreneurship" Challenge, and six special awards at the school level [6]. Additionally, in 2023, senior students from the team were employed by renowned companies such as Didi Kuaidi, Huawei, Yonyou, and

China Mobile Communications Corporation, achieving excellent results in employment through learning [7].

V. CONCLUSION

The echelon-based applied talent cultivation and teaching reform model in the perspective of industry-education integration presents new opportunities and challenges for both education and industrial development. In future development, further improvement and enhancement are required in the following aspects [8]:

A. *Perfecting Team Building*

Further perfecting team building is essential to promote closer collaboration within the industry-education integration team. This includes establishing more communication channels, organizing regular team meetings and workshops, and introducing more innovative and motivational reward systems to stimulate the potential and collaborative spirit of team members. Through continuous improvement in team building, better synergy can be achieved, driving a win-win situation for both education and industry.

B. *Broadening Research Cooperation Channels*

Seeking more opportunities for scientific research cooperation, including collaboration with universities, research institutions, and enterprises at home and abroad. Multi-channel cooperation helps facilitate knowledge exchange, technological innovation, and cross-disciplinary research within the team, providing a broader perspective and resource support for industry-education integration education. Additionally, scientific research cooperation can provide students with more practical opportunities, enhancing their comprehensive qualities.

C. *Enhancing the Research Capabilities of Young and Middle-Aged Teachers*

Most of the team's guiding teachers are young and middle-aged, who play a crucial role in promoting industry-education integration education. Through various school-enterprise collaborations, there can be a highly positive impact on the research capabilities of young and middle-aged teachers. Relying on this platform, more research opportunities and resource support can be provided to teachers. For instance, through projects, teachers can be encouraged to actively participate in educational research projects and publish high-quality research outcomes. Through these measures, more teachers with innovative spirit and educational research capabilities can be cultivated, continuously improving the quality of education.

In summary, the echelon-based applied talent cultivation and teaching reform model under the perspective of industry-education integration has broad prospects for development. By continuously improving team building, broadening cooperation channels, and enhancing teacher research capabilities, more effective integration of education and industry can be achieved, creating more value and opportunities for society.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Ke Wang was responsible for negotiating, signing, and overall progress of corporate projects, while also establishing good relationships with other partners to ensure the successful implementation of projects; Fei Li was responsible for team-building and management, training and development of team members to improve the overall quality and capability of the team; responsible for performance evaluation of team members to ensure efficient operation of the team; Shengying Yang was responsible for project document tracking, research paper writing, ensuring the accuracy and integrity of all project documents, and updating and updating the content of the documents in a timely manner; Yali Luo was responsible for project management, coordinating cooperation between various departments to ensure orderly progress of projects; regularly inspecting the progress and quality of projects and resolving any issues that arise in a timely manner; all authors had approved the final version.

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