Journal of Contemporary Educational Research, 2026, Volume 10, Issue 8
http://ojs.bbwpublisher.com/index.php/JCER
Online ISSN: 2208-8474
Print ISSN: 2208-8466

Exploration and Practice on the Reconstruction of Application-Oriented Undergraduate Talent Training Model Driven by Competitions and Empowered by Interdisciplinary Integration: A Case Study of Energy and Power Engineering Major at Xi'hang University

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Abstract: Combined with the talent training objectives of application-oriented undergraduate universities and the requirements for improving graduates' employability, this paper addresses prominent problems in the cultivation of application-oriented interdisciplinary talents, including inaccurate alignment between training objectives and industrial demands, insufficient support for interdisciplinary competence cultivation, inadequate integration of disciplinary competitions and curriculum teaching, and imperfect comprehensive evaluation systems. It proposes an application-oriented undergraduate talent training model featuring "competition-driven and interdisciplinary-integrated." Driven by interdisciplinary and broad-spectrum disciplinary competitions and targeting the improvement of students' employability, this model reconstructs training objectives and programs for application-oriented interdisciplinary talents, builds a trinity teaching paradigm of "competitions-courses-group meetings," develops micro-competency curriculum modules oriented to competition tasks and post requirements, implements the dual supervisor system of universities and enterprises for interdisciplinary project group meetings, and establishes electronic learning portfolios based on "competency evidence" for students. It systematically connects curriculum teaching, practical training, competition projects, industry-education integration, and competency evaluation. Research results show that this model facilitates the transformation of students' professional knowledge into engineering practice capabilities, improves their interdisciplinary knowledge integration, teamwork and practical innovation abilities, and ultimately boosts their comprehensive competitiveness in employment. It provides referable practical paths for local application-oriented universities to deepen educational and teaching reforms and upgrade talent training quality.

Keywords: Application-oriented undergraduate; Disciplinary competitions; Interdisciplinary integration; Employability; Talent training

Online publication: August 31, 2026

1. Introduction

Application-oriented undergraduate universities undertake important tasks of serving regional economic and social development and cultivating high-quality application-oriented talents. With industrial restructuring, rapid technological advancement, and intensifying employment competition among college graduates, the traditional knowledge-centered talent training model can hardly fully meet the practical demands of industrial development and student growth under the new situation. Local application-oriented universities shall actively respond to regional industrial demands, clarify school-running orientations and construction paths, and continuously enhance the compatibility between talent training and economic and social development [1,2].

Employability serves as a core indicator for measuring the quality of university talent training. The Circular of the Ministry of Education on Doing a Good Job in Employment and Entrepreneurship for College Graduates of 2025 clearly requires "dynamic adjustment of major structures and reform of employment-oriented talent training models." The cultivation of college students' employability relies not only on professional knowledge learning, but is also closely related to comprehensive literacy, including practical ability, innovation capacity, communication and expression skills, as well as teamwork competence. The Circular jointly issued by the State Administration for Market Regulation and the Ministry of Education on Carrying out Pilot Work on Integrating Majors with Standardization Education emphasizes the need to cultivate interdisciplinary talents equipped with both professional knowledge and proficient standardized expertise and skills [3]. The quality of professional training acts as a core variable affecting students' employment preparation behaviors and employment outcomes. Therefore, to solve employment problems of college graduates, universities shall start with optimizing the talent training system and reconstruct an application-oriented interdisciplinary talent training model targeting enhanced employability.

The cultivation of application-oriented interdisciplinary talents must break the limitations of single disciplines and individual courses [4]. Relevant scholars have constructed the framework of literacy, knowledge, and competence that such talents ought to possess [5]. Taking computer majors in Henan Province as an example, researchers have put forward optimization paths including precise alignment with market demands and interdisciplinary training as well as strengthening teaching team construction [6]. Aiming at the disconnection between theory and practice in cross-border e-commerce talent training, typical cases featuring clear objectives and model innovation have been summarized.

Disciplinary competitions constitute an important carrier for cultivating students' practical ability, innovation capacity, and teamwork skills [7]. Existing studies have pointed out that competition-based education modes of "promoting learning via competitions, integrating competitions with learning," "promoting teaching via competitions, combining competitions with teaching," and "promoting collaboration via competitions and collaborative cultivation" can effectively lift students' comprehensive literacy [8]. Against the background of Emerging Engineering Education, integrating competitions with teaching and strengthening the cultivation of practical innovation ability have become important directions for the reform of application-oriented talent training [9]. High-level competitions represented by the National University Chemical Engineering Design Competition feature complete task chains, distinct engineering scenarios, and high requirements for comprehensive abilities, and can act as effective carriers for project-oriented teaching and integration of competitions and courses [10,11]. In addition, existing research also mentions that soft skills such as communication and problem-solving exert important impacts on employability and shall be systematically integrated and continuously improved throughout higher education [12].

On this basis, this paper takes the reform of Energy and Power Engineering Major at Xi'hang University as an example, centers on the logic of "competition-driven and interdisciplinary-integrated," and explores the implementation paths of reconstructing application-oriented undergraduate talent training empowered by interdisciplinary and broad-spectrum disciplinary competitions, so as to provide references for similar universities to improve talent training quality and graduates' employability.

2. Existing problems in application-oriented undergraduate talent training

2.1. Inaccurate alignment between talent training objectives and industrial demands

Talent training in application-oriented undergraduate universities ought to actively connect regional industrial structures and job competency requirements, yet certain gaps still exist in actual training processes. The Energy and Power Engineering Major boasts strong engineering application attributes and interdisciplinary characteristics, and is closely linked to fields such as the energy and chemical industries and new materials, as well as equipment manufacturing. Supported by artificial intelligence, relevant industries witness rapid technological updates and comprehensive job competency requirements, imposing higher standards on students' systematic analysis, engineering design, project collaboration, and lifelong learning abilities.

2.2. Insufficient support for interdisciplinary comprehensive competency cultivation

Practical engineering problems in current industries involve complex factors spanning technology, economy, safety, environmental protection, and management. Students are required to master not only specialized knowledge, but also the integrated and comprehensive application of interdisciplinary knowledge. Though students can grasp several knowledge points of various courses, they often struggle to systematically link procedures including market analysis, process design, equipment selection, economic evaluation, and technical document compilation, as well as achievement presentation, when facing comprehensive projects.

2.3. Inadequate integration between disciplinary competitions and curriculum teaching

Disciplinary competitions exert positive effects on improving students' practical and innovative abilities. Nevertheless, in some teaching practices, competitions are still regarded as extracurricular activities only for a small number of outstanding students, with loose connections to curriculum teaching, practical training, and talent training programs. Competition outcomes are mostly reflected by award levels and quantities, while the reverse promotion effect of competition processes on restructuring curriculum contents and reforming teaching organization and student competency evaluation is underutilized. If disciplinary competitions cannot be fully integrated into the whole talent training process, the expected effects of "promoting learning, teaching and innovation via competitions" can hardly be achieved.

2.4. Imperfect comprehensive evaluation system

Traditional teaching evaluation mostly relies on course examination scores, daily grades, and corresponding practical achievements, failing to fully reflect the growth process of students' comprehensive abilities or effectively support the improvement of employability. Against the backdrop of competition-driven and interdisciplinary integration, students' competency growth is embodied in multiple links, including project advancement, task completion, teamwork, scheme optimization, and achievement presentation. Thus, it is necessary to construct a comprehensive evaluation mechanism based on "competency evidence" to

systematically record and assess students' real performance throughout talent training.

3. Reconstruction of competition-driven and interdisciplinary-integrated talent training model

Centering on the improvement of students' employability and following the general logic of "employment orientation–systematic design–paradigm reconstruction–competency evaluation," this paper takes interdisciplinary and broad-spectrum disciplinary competitions as the driving force and interdisciplinary integration as the main line, carries out systematic reforms in training objectives, curriculum systems, teaching organization, university-enterprise collaboration and evaluation mechanisms, and reconstructs the talent training model for application-oriented undergraduates by building a trinity teaching paradigm of "competitions-courses-group meetings."

3.1. Reconstructing application-oriented interdisciplinary talent training objectives oriented to industrial demands

Talent training objectives serve as the starting point and foothold of talent training system construction. Focusing on national strategic demands and regional industrial characteristics, job demand investigations are carried out covering the energy chemical industry and new materials and equipment manufacturing fields, forming a Research Report on Coupling Degree Analysis and Countermeasures Between Industrial Demands and University Training, which provides objectives and a basis for reconstructing training objectives and programs for application-oriented interdisciplinary talents.

3.2. Driving the restructuring of curriculum contents through project-oriented competition tasks

The core of competition-driven talent training reform lies in transforming competition tasks into project tasks. Taking the National University Chemical Engineering Design Competition as an important carrier of interdisciplinary competitions, competition contents are decomposed into links including market analysis, process route design, equipment design, economic evaluation, and achievement presentation, which correspond to curriculum contents, project tasks, and competency outputs respectively [13].

3.3. Building micro-competency curriculum modules to make up students' deficiencies in engineering practice ability

Aiming at inadequate competency cultivation and inflexible responses to competition and job demands under traditional curriculum systems, micro-competency curriculum modules oriented to competitions and employment demands are constructed. Micro-competency modules help break the boundaries of traditional courses and push the transformation of curriculum systems from knowledge units to competency units. Adopting the hybrid teaching mode of "online theory + offline practice," students can complete real task training on the basis of mastering basic theories, realizing effective integration of knowledge learning, skill training, and engineering application.

3.4. Implementing the dual supervisor system of universities and enterprises and establishing the operation mechanism of interdisciplinary project group meetings

Interdisciplinary competition tasks feature long cycles (over six months) and complex knowledge coverage, which cannot be satisfied merely by classroom knowledge. Drawing on the seminar system for postgraduates, regular interdisciplinary project group meetings are adopted as a major organizational form, with the dual supervisor system involving both on-campus academic tutors and off-campus industrial tutors from enterprises.

During project group meetings, the regular operation of interdisciplinary projects enables teachers to timely grasp students' project progress and competency deficiencies for targeted guidance. Meanwhile, students can boost their capacity for problem analysis, teamwork, and engineering expression through continuous reporting, discussion, and revision, and adapt to the rhythm of postgraduate study and future work in advance.

3.5. Establishing electronic learning portfolios for students and perfecting the competency evidence-based evaluation system

Evaluation mechanisms act as an important guarantee for the sustainable advancement of talent training model reforms. By establishing electronic learning portfolios for students, all "competency evidence," including competition achievements, competition contributions, and group meeting outputs, are systematically collected, forming a multi-dimensional, process-oriented, and competency-centered comprehensive evaluation system.

4. Reform achievements

The competition-driven and interdisciplinary-integrated talent training model takes interdisciplinary broad-spectrum competitions as the core driving force, the trinity teaching paradigm of "competitions-courses-group meetings" as the implementation carrier, and the competency evidence-based comprehensive evaluation system as the quality guarantee. It organically connects the cultivation of employability, curriculum teaching reform, practical competency training and industry-education integration, and converts scattered teaching reform measures into a systematic talent training reform system with clear objectives, definite paths, controllable processes and traceable evaluations. After preliminary exploration and practice, this model has yielded certain results: students' engineering practice and competition innovation capabilities are effectively improved; their capacity to develop and transform innovative achievements is enhanced; the reform achievements of talent training have been recognized by the university [14].

5. Promotion value

In terms of popularization and application, this model boasts strong practical value and reference significance. First, it provides a systematic solution for application-oriented undergraduate universities to resolve the disconnection between talent training and market demands. Second, it offers operable paths to deepen industry-education integration and lift employment quality [15]. Finally, the construction method of micro-competency modules, university-enterprise dual supervisor project group mechanism, and student

electronic portfolio evaluation tools formed under this model enjoy favorable transferable application value. They are applicable not only to Energy and Power Engineering Major, but also provide references for engineering majors such as Materials, Chemical Engineering, Environment and Mechanical Engineering, as well as other majors requiring cultivation of interdisciplinary integration and practical innovation abilities.

Generally speaking, this model features clear objective orientation, operable implementation paths, and evaluable outcomes. It can provide useful references for local application-oriented undergraduate universities to advance educational and teaching reforms, upgrade talent training quality, and strengthen their capacity to serve regional industrial development.

6. Conclusion

Disciplinary competitions serve an important carrier for application-oriented undergraduate universities to improve students' practical, innovative, and employment abilities. Centering on the logic of "competition-driven and interdisciplinary-integrated," the reform carried out by the Energy and Power Engineering Major of Xi'hang University addresses problems including inaccurate alignment between training objectives and industrial demands, insufficient support for interdisciplinary competency cultivation, inadequate integration of disciplinary competitions and curriculum teaching, and imperfect comprehensive evaluation systems. It puts forward a systematic reform path guided by industrial demands, driven by interdisciplinary competitions, supported by the "competitions-courses-group meetings" carrier, and guaranteed by competency evidence evaluation. Follow-up work shall further perfect the dynamic adjustment mechanism of training objectives, interdisciplinary curriculum coordination mechanism, operation mechanism of university-enterprise dual supervisors, and competency evidence evaluation mechanism, continuously promote in-depth integration of competition driving and the whole talent training process, and provide referable practical experience for local application-oriented universities to deepen educational and teaching reforms and upgrade talent training quality.

Funding

This research was supported by the Higher Education Teaching Reform Research Project of Xi'hang University (25JXGG1011) and the 2025 Research Project of Shaanxi Provincial Education Science 14th Five-Year Plan (SGH25Y3289).

Disclosure statement

The authors declare no conflict of interest.

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