

# Construction of Talent Training Mode of "Promoting Ability through Competition and Collaborative Innovation" in Local Universities

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**Abstract:** The current situation of discipline competition practice in local universities is analyzed. The main problems and deficiencies of "university, instructors and participating students" are pointed out. Based on the achievements of civil engineering discipline competition in recent years, the closed-loop collaborative practice mode of discipline competition with three subjects of "participating teachers, students, evaluation experts, organization and management department" is constructed. In this mode, the collaborative function of each subject is clarified. Practice has proved that the closed-loop coordination mode of discipline competition can enhance the innovation ability of engineering teachers and students in universities and improve the effect of discipline competition.

## 1. Introduction

In order to serve the national strategy initiatives, such as a new round of scientific and technological revolution and industrial transformation, supporting innovation driven development and "made in China 2025", it is urgent to cultivate innovative talents in short supply [1]. In recent years, the number of undergraduate and postgraduate students in China has increased significantly. It is particularly important to explore the cross, comprehensive, practical and effective talent training mode [2]. Therefore, this paper takes a local university as example to explore a new talent training model, which takes discipline competition as the core and emphasizes the collaboration of undergraduates, master students and instructors.

## 2. Analysis of current situation of Subject Competition

### 2.1. Analysis of the present situation of subject competition in Chinese Universities

In the document retrieval system of China National Knowledge Infrastructure, the number of papers published from 1983 to 2018 was 2351 by using "discipline competition" as the key word. Before 2002, few papers were published in discipline competitions, indicating that there was less practice and research work in developing discipline competitions in China before 2002. After 2003, the overall growth trend of the number of papers in subject competitions is obvious, and the number of documents has increased rapidly in recent years, accounting for a high proportion in the total documents, indicating that more and more universities and teachers in China have carried out practical research work related to subject competitions.

### 2.2. Analysis on the present situation of civil engineering discipline competition in Chinese Universities

In the document retrieval system of China National Knowledge Infrastructure, the key words are "subject competition" and "architecture" or "civil engineering", in which the key words of "subject competition" are accurate retrieval, and the key words of "architecture" and "civil engineering" are fuzzy retrieval. It was found that there was no relevant paper published in 2002 and before, and the

number of papers published from 2003 to 2018 was 46. From 2009 to 2014, the number of documents showed a fluctuating growth trend. After 2015, the number of papers published steadily increased, and its proportion in the total documents also increased rapidly. From 2009 to 2014, the number of documents showed a fluctuating growth trend. After 2015, the number of papers published steadily increased, and its proportion in the total documents also increased rapidly. Historically, the number of papers published in this field is still relatively small, but it is gratifying that the number of relevant documents has increased rapidly in recent years. The number of papers published in 2017 and 2018 alone accounted for 52% of the total number of historical papers. This shows that domestic civil engineering discipline competitions are receiving more and more attention and are developing well. It is believed that relevant research literature and practical work will gradually increase in the future [3].

### **3. Main problems**

Through the investigation and analysis of typical local universities, we think that the problems in the current talent training process mainly include the following:

(1) The number of students is surging, the teacher resources are insufficient, and the structural contradiction of the overall high student teacher ratio is prominent. According to statistics, in 2021, the number of ordinary undergraduate students in China exceeded 18 million, and the number of master's degree students in China exceeded 2.8 million. Ordinary undergraduate schools have about 1.27 million full-time teachers, and the overall student teacher ratio is about 16.4. The structural contradiction of the overall high student teacher ratio is relatively obvious [4].

(2) Personnel training funds are insufficient. Local universities have limited funds. Take Zhongyuan Institute of technology as an example. From 2015 to 2017, the daily operation expenditure of undergraduate teaching per student was maintained between 1785 Yuan and 1825 Yuan, and the expenditure of undergraduate experimental practice per student was maintained between 333 Yuan and 377 Yuan. The overall investment was relatively stable. From the daily operating expenses of undergraduate teaching per student and the experimental practice expenses per student, the University's low investment in students is also a more prominent problem.

(3) The experimental site and instrument and equipment resources are insufficient. Engineering majors require students to do a lot of practical exercises and hands-on operations, which puts forward higher requirements for practice sites and instruments and equipment. Due to the constraints of funds and space, there are insufficient laboratories and engineering training venues in local colleges and universities, and the practice venues owned by them also have problems of insufficient openness to varying degrees [5].

(4) Teachers do not give enough guidance to students. On the one hand, teachers' teaching tasks are heavy. Most local college teachers take several courses every semester, and the courses change frequently. They have heavy tasks such as lesson preparation, handwritten teaching plans, and teaching PowerPoint production. On the other hand, teachers are under great pressure for scientific research. Annual assessment, employment assessment, etc., coupled with the entanglement of school affairs, make teachers' time and energy cannot be fully used in the education link.

(5) Some students are lack of ideological understanding and learning enthusiasm. Ignoring the importance of combining theory with practice, there is a phenomenon of emphasizing classroom knowledge and ignoring practical application. They fail to plan their own time and energy scientifically and mistakenly believe that discipline competitions will take up too much time for learning theoretical knowledge. In fact, they lack effective management of their own time.

### **4. Construction and implementation of talent training mode of "promoting energy through competition and collaborative innovation"**

The closed-loop collaborative practice mode of subject competition takes "participating teachers and students + review experts + organization and management departments" as the main body of the mode (Figure 1). On the basis of clarifying the functional orientation of each subject, we should

give full play to the cooperative efficiency of multiple subjects and achieve the overall optimal effect of the closed-loop process of discipline competition.

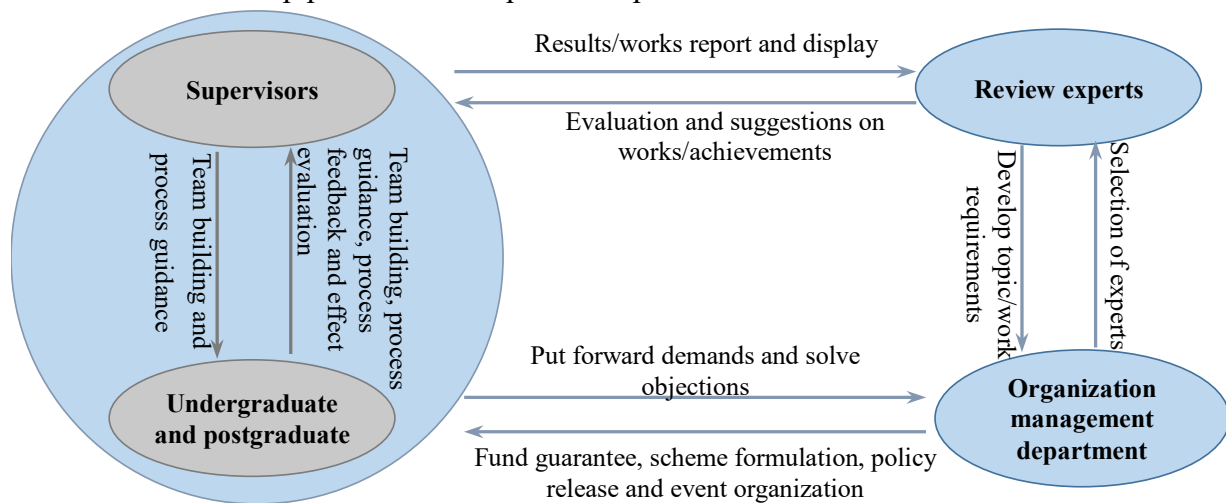


Figure 1 Talent training mode of "competition to promote energy and collaborative innovation".

#### 4.1. Participating teachers and students

(1) Participating teachers and students are the first subject of subject competition. The participating teachers and students need to report and display their achievements / works / achievements to the evaluation experts, and also put forward their needs for competition and objection resolution to the organization management department.

(2) Teachers' collaborative guidance. The instructor is the initiator of the participating teacher-student community, and has the role of building a competition team and guiding the implementation process. Practice has proved that local colleges and universities cannot copy the tutorial system of key colleges and universities. Compared with the single guidance teacher model, a team of guidance teachers composed of multiple teachers who are cooperative, inclusive and complementary can better improve the level of student guidance in local colleges. Therefore, teachers' teams should be encouraged to guide students in discipline competitions.

(3) Group guidance. The tutorial system in the modern sense highlights the student-centered status [6]. It usually takes 3-4 students as the general units, and the guidance teachers carry out personalized guidance for group students. It coincides with the team teacher-student collaboration required by the discipline competition. The group guidance also facilitates teachers to guide undergraduates with the discipline competition as the carrier.

(4) Appropriately introduce graduate students. In order to make up for the shortage of guidance teachers in local colleges and universities, measures can be taken to appropriately introduce postgraduate students among the participating students [7]. This can not only exercise the ability of postgraduate students to lead undergraduates, but also enable undergraduates and postgraduate students to form a community of participating students, give play to their synergy, encourage each other, and enhance their confidence in struggle.

(5) Strengthen the interaction between teachers and students. The participating students should timely feedback the difficulties and problems they face in the process of participation to the guidance teachers, which is conducive to the guidance of teachers to the student community, as well as the guidance teachers to evaluate the progress effect of the participating students, timely and dynamically grasp the team situation, accurately make countermeasures, and jointly give play to the interactive and collaborative advantages of the participating teachers and students.

#### 4.2. Reviewers

(1) Evaluation experts are the key subjects of discipline competition practice. The evaluation experts selected by the organization management department shall study and formulate the competition topics or work requirements according to the objectives, characteristics and

requirements of the discipline competition, and give the competition work requirements and evaluation indicators. The evaluation of expert competition topics should strive to highlight the orientation of social practical problems, test the ability of students to solve practical problems using the knowledge they have learned, and also use the competition results to provide countermeasures for solving practical problems.

(2) The evaluation experts are the objects to report and display the results / works of the competition between the participating teachers and students. We should give full play to the advantages of the evaluation experts, give objective, fair and impartial performance evaluation and suggestions to the results / works submitted by the participating teachers and students, and provide expert suggestions for further improvement and promotion of the competition between teachers and students.

#### **4.3. Organization management department**

(1) The organization and management department is the guarantee subject of discipline competition practice. The organization and management departments involved include the academic affairs office, the Youth League Committee, the innovation and entrepreneurship guidance center, the laboratory management center, the secondary college and the off campus units of the University.

(2) Attach importance to process management and provide mechanism guarantee. Selection of evaluation experts, setting of participants, formulation of competition scheme, competition content, award setting, implementation of competition organization, release of competition topics, etc., to provide guarantee for competition mechanism and process management.

(3) Provide policies and incentives to mobilize the enthusiasm of the main body. Discipline competition will be included in the talent training plan, the content of discipline competition will be reflected in the evaluation and employment of professional titles and performance assessment, the reward for winning teachers and students will be increased, and the enthusiasm of participants will be mobilized in the form of policies and rewards.

(4) Multiple measures were taken simultaneously to provide financial guarantee. The organization and management departments take various measures to expand the sources of funds, and can carry out industry university cooperation and collaborative competitions with social entities or enterprise bases to raise competition funds in various ways.

(5) Strengthen the integration of laboratory and subject competition, open the laboratory and practice training base, improve the utilization rate of venues, instruments and equipment, and fully develop the experimental software and hardware conditions.

(6) Appropriately reduce the student teacher ratio. Teachers are the first resource of colleges and universities, and a low teacher-student ratio is an important feature of excellent universities in the world. Efforts should be made to control the student teacher ratio in local colleges and universities within a reasonable range. There are two main measures: one is to strengthen the introduction of teachers; Second, optimize the level of running schools and gradually reduce the enrollment of junior college students and part-time undergraduate students.

#### **5. Application**

The closed-loop collaborative practice mode has been applied to the civil engineering discipline competition practice of our university since 2017, with good results (Table 1). In particular, in 2019, the fourth national construction college construction technology application skills competition, which guided students to participate in, won the first prize in November; The 14th "Challenge Cup" Henan University Students' extracurricular academic and scientific works competition, which guided students to participate in, won the second prize in May. Through the investigation of the students participating in the subject competition, it is found that the students have a high recognition of the closed-loop collaborative practice mode of the subject competition, and believe that the closed-loop collaborative practice of the subject competition has tempered their innovative practical ability, and has a positive effect on their future employment and further study.

Table 1 Awards of students in 2019.

Name of competition	Undergraduate Metallographic Skills Competition	Building Construction Simulation Application Skills Competition	Construction Technology Application Skills Competition	"Challenge Cup" Undergraduate Academic Science and Technology Works Competition
Results	Provincial first prize	Provincial first prize	National first prize	Provincial second prize

## 6. Conclusion

Discipline competition is conducive to the sound development and talent training of Engineering Majors in local universities. The closed-loop collaborative practice mode of discipline competition proposed in this paper includes the three main bodies of "participating teachers and students + evaluation experts + organization and management departments", which effectively solves the main problems and shortcomings of civil engineering majors in local universities, and is of great significance to improve the optimal cooperation of participating teachers and students, evaluation experts and organization and management departments, and improve the discipline competition level of civil engineering students. In particular, the application of this model in civil engineering major discipline competitions in recent years has effectively trained and trained a number of discipline competition teachers and students, accumulated discipline competition experience, and laid a solid foundation for further playing the role of discipline competition in civil engineering professional talent training.

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