



# Research on the Cultivation Mode of Applied Innovative Talents for Computer Science Majors Driven by Discipline Competition

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**Abstract.** Combined with the needs of cultivating applied innovative talents in computer science majors, we analyze and summarize the important role of discipline competitions, which can optimize the professional talent cultivation program, feed the practical teaching and scientific research training, and cultivate innovative thinking and team spirit. We put forward the way of "based on practical teaching, driven by discipline competitions, supported by team building, and based on the concept of result orientation", so that students can grow up and become successful in "learning, thinking, practicing, creating, and realizing". It provides a theoretical basis for the exploration of applied innovative talents training mode of computer science majors based on the concept of OBE and driven by discipline competition.

**Keywords:** disciplinary competition; computer science majors; OBE Philosophy; innovation ability; talent cultivation.

## 1 Introduction

The report of the 20th Party Congress pointed out that "education, science and technology, and talent are the basic and strategic support for the comprehensive construction of a socialist modernized country"<sup>[1]</sup>, for the first time, the three major strategies of education, science and technology, and talent are planned as a whole. At present, there is a serious homogenization of talent training in higher education, students' innovation ability and the ability to apply the knowledge and skills to solve life problems are insufficient, and there is a "disconnect" between the supply side and the demand side, which makes it difficult for college graduates to find employment or have a low quality of employment, etc. How to combine the characteristics of disciplines to cultivate innovative, talented people? How to combine the characteristics of disciplines to cultivate innovative, application-oriented and skill-oriented talents is a prac-

tical problem that higher education needs to solve, and is also an inevitable requirement under the development trend of the times.

As a part of the teaching system of colleges and universities, academic competition is closely integrated with practical teaching and is an important part of the second classroom. It can test the ability of students to apply the knowledge and skills they have learned to solve practical problems innovatively, and it is also a competition between students of different majors in different grades and different institutions. Through the discipline competition, it can stimulate students' enthusiasm for professional learning and the cultivation of innovation ability, enhance students' ability of independent thinking and the level of solving practical problems, and has a better demonstration and leading role. Under the background of the construction of new engineering disciplines, based on the concept of OBE result-oriented education, the cultivation of computer science professionals also needs to effectively combine professional knowledge and practical ability through discipline competitions, and enhance students' innovative thinking and innovative ability. Therefore, discipline competitions are also getting more and more attention from colleges and universities, actively organizing students to participate in them, and gradually becoming an important path for education and teaching reform, especially innovation and entrepreneurship education reform.

## **2 The important role of discipline competitions in the cultivation of applied innovative talents of computer class majors**

### **2.1 The role of disciplinary competitions in optimizing and improving professional talent training programs**

Professional training program is a normative document for colleges and universities to implement the overall requirements of the party and the country on talent training, organize teaching activities and arrange teaching tasks, and is the basic basis for the implementation of professional training and quality evaluation<sup>[2]</sup>. With the development and progress of science and technology, the computer industry has been updated and iterated very rapidly, which has a powerful impact on the cultivation of computer professionals, and colleges and universities have to keep abreast of the times, revise the professional curriculum and cultivation objectives, optimize and improve the professional training program in a timely manner, and adapt to the needs of social development. Through disciplinary competitions, we can effectively test students' mastery of professional knowledge and skills, compare the gap with the same specialty in similar universities and universities, understand the short boards that exist with the social demand for talents, adjust the talent training objectives and curriculum settings in a timely manner, accurately design the professional graduation requirements according to the characteristics of the specialty, and build an effective talent training system.

## **2.2 Reinforcement and feeding of discipline competitions on practical teaching and scientific research training**

Practical teaching is an indispensable part of course teaching, which is a good way to test students' ability to apply knowledge and skills, and is the embodiment of the unity of knowledge and practice. The curriculum will arrange reasonable practical teaching content according to the needs of talent training, these contents are the test of students' mastery of knowledge, but also the application of creative theoretical knowledge to practice. For computer science majors, many experimental training projects will be combined with the actual life, divided into validation, design and comprehensive experimental training, some courses final assessment task is to arrange for students to complete a comprehensive course design, in general, has a very strong practical.

Discipline competitions are a process of "learning, thinking, practicing, creating and realizing", which is the upgraded version of the effectiveness testing of practical teaching of the curriculum, and can strengthen and feed back to practical teaching and scientific research training. The requirements for teachers' teaching ability in discipline competitions are much higher than those in the first classroom. Teachers who guide students to participate in discipline competitions can further improve their own teaching and business ability, and promote the reform of education and teaching<sup>[3]</sup>. Combined with the subject requirements of discipline competitions, the usual assignments, comprehensive experimental training or final course design that meet the selected topics in daily practical teaching can be processed in depth and then evolved into competition works. Combined with the competition situation and the cultivation objectives of the course, teachers can improve the teaching methods and means and the difficulty intensity of practical teaching, combine the teaching content with the disciplinary competition, strengthen the connection between the daily experimental training tasks and the competition works, and encourage students to actively participate in the competition for the practical test. If the works are awarded, teachers can transfer the results of the competition works back to the comprehensive experimental practical training teaching, through such a spiral sustainable development, and constantly promote the mutual transformation of the results of disciplinary competitions and teaching, which fully reflects the concept of OBE, and promotes the cultivation of application-oriented innovative talents.

Starting from scientific research training, students can participate in teachers' scientific research projects to broaden their professional knowledge; they can also be instructed to declare college students' scientific research projects from their professional fields to carry out systematic scientific research training, which helps to cultivate systematic thinking and improve practical application ability. For the stage results of scientific research projects, students are encouraged to participate in competitions if they meet the requirements of the theme of discipline competitions, which not only can test the research results, but also can be optimized and improved through the suggestions and comments made by the teachers of the judging panel. By the same token, the excellent results of the works awarded in the disciplinary competitions can also be encouraged to declare the scientific research projects of college students,

which can promote students' continuous and in-depth research and effectively improve their scientific research ability. Eventually, the organic integration of disciplinary competitions and scientific research training will be realized, and the advantages will be complementary.

### **2.3 The role of disciplinary competitions in fostering and consolidating students' innovative thinking and team spirit**

Bridge et al. believe that innovation and entrepreneurship education is committed to cultivating individuals with professional knowledge and skills and a sense of innovation, and that these knowledge and skills and innovation and entrepreneurship awareness will lay a solid foundation for personal growth and success, employment and entrepreneurship<sup>[4]</sup>. In addition to testing and strengthening students' solid theoretical knowledge and practical skills, discipline competitions can help innovation and entrepreneurship education, stimulate learning interest, cultivate students' sense of competition and teamwork<sup>[5]</sup>, and improve engineering practice, enhance their innovative thinking and innovation ability, which is a good embodiment of "integration of specialized knowledge and innovation".

Through understanding the competition questions, students conceptualize the entry plan, design, produce and perfect the entry works<sup>[6]</sup>, thus effectively combining professional knowledge and practical ability, and drilling immersively to complete the works. In the judging process, the works are more likely to be favored by the judges if they are cleverly conceived and novelly created. Therefore, it is necessary to stimulate the innovative thinking of team members, find breakthroughs, skillfully create and complete the works, and ensure the novelty and originality of the works. After ensuring the quality of the work, students have to prepare various defense materials, self-presentations or explanations, questions from the judges, etc., which comprehensively test the students' abilities in copywriting, oral expression, flexibility and psychological quality. During the months-long competition cycle, team members study together and cooperate with each other, which will produce a tacit understanding and achieve a mutually beneficial and win-win effect.

In the education reform of colleges and universities in the new era, the integration of competition for learning, competition for teaching and creation and competition can effectively integrate professional education and innovation and entrepreneurship education, better enhance the comprehensive ability of students in all aspects, mobilize the enthusiasm and initiative of extracurricular practical training and exercise, enrich the activities of the second classroom, and provide a good boost for the graduation design, graduate school, entrepreneurship and employment that will be carried out in the subsequent period. Discipline competitions also provide support for undergraduate program audit and assessment, comprehensive evaluation of majors, professional certification, discipline construction and other aspects of universities, becoming a necessary condition in the modern education system.

### **3 Exploration of the cultivation mode of applied innovative talents of computer class majors driven by disciplinary competitions**

#### **3.1 Strengthening the organic combination of knowledge and ability in teaching based on practical teaching**

As a rule, the practical teaching of most courses is mainly based on traditional verification experimental training, which is relatively simple, focusing on basic knowledge and lacking comprehensive and innovative practice, and there is relative separation of practical teaching between different courses, which fails to carry on and integrate knowledge and skills well. In view of these situations, we take students as the center, reconstruct the three-level ability cultivation system of "course experiment + professional practical training + comprehensive innovation", infiltrate and integrate the concept of practical teaching into theoretical teaching, strengthen the cultivation of students' application ability, and realize the organic combination of knowledge transmission and ability cultivation. In the lower grades, the experimental training of basic courses is used to cultivate students' basic abilities of independent thinking, basic operation and problem analysis, and the knowledge of innovation and entrepreneurship education is integrated to cultivate innovation and entrepreneurship awareness; in the middle grades, the experimental training of core courses and orientation courses is used to cultivate students' ability of applying professional and technical knowledge in creation and design; and in the upper grades, the comprehensive practical courses, pre-service practical training, graduation design, innovation and entrepreneurship project practical training are used to cultivate the ability of students to apply professional and technical knowledge to creation and design. In the upper grades, comprehensive practical courses, pre-job practical training, graduation design, innovation and entrepreneurship project practical training are used to cultivate students' comprehensive and innovative problem-solving ability. The lower, middle and upper grades have different focuses, and the practical teaching is carried out according to course experiments, professional practical training and comprehensive innovation in order, which has a certain degree of extension for the consolidation of course knowledge and skills.

At the same time, combined with the development of the industry and market demand, the content of practical teaching to keep pace with the times, select cases and comprehensive practical training content with industry representativeness or typicality, but also can be introduced into the local enterprises to carry out school-enterprise cooperation, through the "go out, please come in" way, so that students understand the cutting-edge industry dynamics, and further enhance the students' sense of identity and deep understanding of the profession and the industry. Through "going out, inviting in", students can understand the cutting-edge industry dynamics and further enhance their sense of identity of the specialty and deep-level understanding of the industry. In addition, fully explore the local characteristics of resources, play the role of cultural education, focus on the integration of elements of political thinking, broaden the depth and breadth of the content of practical teaching, so that the course of politi-

cal thinking and political courses in the same direction, synergistic innovation, but also for the service of local economic and social development to plant the seed.

### **3.2 Improving the training mode of applied innovative talents driven by discipline competitions**

Taking the latest national catalog of university student competitions released every year as the main channel for discipline competitions, we focus on computer-based professional competitions and innovation and entrepreneurship competitions, such as: Chinese Collegiate Computing Competition, International Collegiate Programming Contest, China College Students' 'Internet+' Innovation and Entrepreneurship Competition, and so on. At the same time, taking into account the Huawei ICT Competition and other related competitions in the computer industry, students can get in touch with related enterprises in advance and understand the current market demand and work tasks in the industry.

Taking Baoshan University as an example, the School of Big Data integrates Huawei's certified course system into the talent training program, focusing on cultivating innovative talents for engineering practice in new engineering disciplines, thus effectively shortening the competence requirements of Huawei's industrial chain for ICT talents. We have actively constructed a "three-industry fusion" discipline competition practice system integrating "specialization+innovation and entrepreneurship+industry" to improve the cultivation mode of applied innovative talents, strengthen the comprehensive quality cultivation of students, and improve the competitiveness of employment. On the basis of practical teaching, combined with the individual development of students, targeted organization of students to participate in various disciplinary competitions, which is conducive to the expansion and updating of professional knowledge, the introduction of new hotspots and new technologies, better expanding the knowledge of students, and enhance the interest in learning. Teachers make a conscious effort to link different groups of students with strengths in development skills, copywriting, and oral presentation to team together to ensure the quality of their work.

Usually, lower grade students are actively encouraged to participate in various kinds of basic disciplinary competitions on campus or participate in the projects of higher grades as team members, familiarize themselves with the rules, processes and precautions of the competitions first, and invite some of the outstanding works of the teams to perform demonstrations and experience exchanges within the scope of the corresponding professions, so as to stimulate the interest of professional learning of the students in the lower grades, cultivate the sense of competition and enhance the innovative thinking; the middle grades as the main force of the disciplinary As the main force of disciplinary competitions, on the basis of the experience accumulated in the first year of college, we encourage students to participate in various types of disciplinary competitions at the provincial and national levels to further strengthen the innovation ability of analyzing and solving problems, and the excellent works will be created as a case study to share with the lower grades students, analyze the strengths and weaknesses of the works, and provide references for the subsequent competitions;

the upper grades, in addition to the students who have actively prepared for the master's degree, are also encouraged to continue to participate in the competitions, but more for the lower grades students. However, it is more of a guidance and motivation for the lower grade students, so that they can continue the experience of the competition, achieve the effect of "passing on the experience" and improve the award rate of the works.

### **3.3 Team building as a means to form a faculty team for the training of applied and innovative talents**

Most of the discipline competitions are conducted in a teamwork manner, mainly involving student teams and instructor teams. Through in-depth cooperation between schools and enterprises, based on the needs of the industry, We are actively building professional studios and developing student-centered "studio project-based" teaching, focusing on the OBE concept, integrating research, teaching, competition and innovation and entrepreneurship, so that teachers and students can win and create together. Taking Baoshan University as an example, a team of teachers set up and are responsible for guiding three student teams in Software Development Center, Digital Media Studio and Robot Programming Studio, and the students join the groups of front-end development, back-end development, computer vision, Internet of Things application, film and television creation, animation design, virtual reality, microcurriculum creation, and robot programming, etc., adopting the mode of "bringing the old to the new, passing on the skills to the new", strengthening the extracurricular practical training exercise, and improving the professional ability<sup>[7]</sup>.

Through the development of various disciplinary competitions, mobilize students of different computer majors and grades to participate in projects and practical training sessions, teachers specializing in different professional fields to work together to guide, can effectively mobilize the enthusiasm of teachers to establish a team of instructors, and work together to cultivate students' teamwork and collaboration ability, laying the foundation for professional team building. Regularly arrange students to go out of school and enter enterprises to carry out practical training and internship, invite relevant leaders or entrepreneurs of practice bases to carry out innovation and entrepreneurship or professional field lectures, and participate in the guidance of disciplinary competitions, so as to improve the practical teaching effect and disciplinary competitions through "going out and inviting in", strengthen the team faculty and perfect the team. Cooperation Mechanism.

### **3.4 Optimizing the evaluation mechanism for the training of applied innovative talents based on the concept of results orientation**

Outcome-oriented education model is currently adopted by the United States engineering education, Srinivasa proposed that in order to effectively achieve the "results" of the course, it is necessary to implement PBL in the teaching process, because OBE is a kind of transformation, certification is also based on OBE <sup>[8]</sup>. Based on the concept of OBE, the theoretical teaching curriculum system is reconstructed with the

value orientation of practical application, abandoning the "large and comprehensive" subject knowledge system, "highly sophisticated" academic theoretical knowledge, insisting on the basic principle of "practical, sufficient and useful", and emphasizing the "results" in the teaching process. We emphasize the comprehensiveness and innovation of students' professional knowledge, and the demand for applied and innovative talents in the social industry is met through reverse design and positive implementation, so as to ensure the unity of the educational objectives and educational results, and to let students really "apply what they have learned and integrate knowledge with practice".

Through the implementation of the "teaching, competition and research integration" path of specialization and innovation integration, the combination of the first classroom and the second classroom, the combination of competition and professional knowledge, the combination of teaching and competition, the combination of scientific research and competition, and the reasonable stimulation of the students' subjective initiative. According to the various aspects of disciplinary competitions, different evaluation and assessment of students' innovation ability are carried out, jointly promoting the integration of competition, teaching, scientific research, innovation and entrepreneurship, and optimizing the evaluation mechanism for the cultivation of applied innovative talents.

Take the Chinese Collegiate Computing Competition as an example, the first ring is to set up a team, to test students' communication and coordination, interpersonal and organizational skills, to consider the team's demand for personnel from a multi-dimensional perspective, and to lay the foundation for good cooperation in the subsequent team. The second ring is to select the topic and material, to test students' political acumen, insight, independent learning, information retrieval ability and dispersive thinking and innovation, and to ensure that the works are based on accurate intention and contain cultural background. The third ring is the creation of the work, the examination of students' planning and implementation ability, teamwork, the application of comprehensive knowledge and skills and professional execution, based on a clear division of labor, team members play their respective roles, collaborate with each other to carry out the creation, and to ensure the quality and efficiency; the fourth ring is the effect of the finished products. The fourth ring is the effect of the finished product, which examines the students' self-reflection ability, the spirit of craftsmanship and critical spirit of excellence, and considers whether the effect of the finished product achieves the expected effect, whether the content is smooth, whether the logic is reasonable, etc., and how to modify and optimize the deficiencies to ensure that the work is close to perfection. The fifth ring is the on-site defense, which examines the students' ability in copywriting, courseware production, language expression, mental quality, etc., which is based on a clear division of labor. The fifth ring is the on-site defense, which examines the students' ability in copywriting, language production, mental quality, etc. It introduces the advantages, highlights and characteristics of the works around the introduction of the works, creative ideas, technical routes and team division of labor. Through the interlocking and five-ringed force, driven by disciplinary competitions, the goal of talent cultivation is docked to the demand of the social market, realizing the unity of educational goals and educational results, strengthening



the students' ability to link theory with practice, and cultivating applied and innovative talents in computer science to meet the needs of the social industry.

## 4 Conclusions

Through disciplinary competitions, we can optimize and improve professional talent training programs, strengthen and feed practical teaching and scientific research training<sup>[9]</sup>, and cultivate and consolidate students' innovative thinking and team spirit. Based on the concept of OBE results-oriented education, discipline competitions can be effectively integrated into the whole process of cultivating applied innovative talents, so that students can "learn, think, practice, create and realize" in the process, which can maximize the role of supporting the cultivation of innovative talents, effectively promote the professional teaching and discipline construction, and promote the reform of curriculum system, teaching content and teaching methods. Reform of Curriculum System, Teaching Content and Teaching Methods<sup>[10]</sup>. According to the experience and insights of guiding students to participate in discipline competitions for a long time, we actively explore the model of cultivating applied innovative talents in computer science majors driven by discipline competitions, and put forward the idea of "taking practice teaching as the basis, strengthening the organic combination of knowledge and ability in teaching, taking discipline competitions as the driving force, perfecting the model of cultivating applied innovative talents, taking team building as the handhold, setting up a team of teachers for cultivating applied innovative talents, and taking team building as the handhold, setting up a team of teachers for cultivating applied innovative talents. Innovative talents training teacher team, results-oriented concept, optimize the evaluation mechanism of applied innovative talents training", and through years of practice testing, achieved certain results, can provide reference for similar local undergraduate colleges and universities. Of course, there are differences among various disciplines in various universities, and it is a long-term process to improve the training mode of applied innovative talents, which needs to be constantly modified and adjusted to adapt to the changes and development of social demand and better cultivate high-quality applied innovative talents specialized in computer science for the society.

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