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Construction for the "1234" innovative ability cultivation mode, focusing on improving the quality of applied talents cultivation

Tao Wang, Jiarui Guo, Haiyun Xu, Xiaojuan Wang, Shumin Chen, Hui Dong

Shangqiu Normal University, Shangqiu, Henan, 476000, China

Abstract: *Cultivating the innovation ability and thinking of undergraduates and improving the practical operation ability of undergraduates is a powerful starting point for improving the quality of application-oriented talent training, and it is a measure and effective method for local undergraduate colleges to build a high-level application-oriented university. Based on the development plan of our school's "14th Five-Year Plan" and taking the School of Chemistry and Chemical Engineering as an example, this paper elaborates on the background, strategy, effect of construction, and future work ideas and assumptions of the "1234" innovation ability cultivation model. It provides reference and reference for the exploration of talent training in sister universities and their science and engineering departments.*

Keywords: *Applied Type, Talent Training, Tutor System, the Second Classroom*

1. Introduction

In recent years, many local undergraduate colleges and universities have entered the fast lane of transformation and development to build high-level application-oriented universities. Combined with the economic and social development needs of local industries and enterprises, the training and output of high-quality application-oriented skilled talents is a problem for local colleges and universities. . Therefore, how to take strong measures to strengthen the quality of applied talents training, improve the innovative thinking of undergraduates, stimulate their professional cognition and interest in learning, and strengthen students' practical ability is a question worth thinking about. The School of Chemistry and Chemical Engineering of Shangqiu Normal University, through continuous exploration, innovates the carrier and form of the second classroom, innovates the teaching mode and class hour allocation in the practical operation, and establishes professional associations with characteristics and a high degree of fit with the major, so as to cultivate and develop innovative thinking for students. Practical hands-on training provided strong support and achieved certain results, improving the quality of applied talent training to a certain extent[1].

2. The background of the construction of the "1234" innovation ability training model

During the "14th Five-Year Plan" period, the school adhered to the overall development idea of "stabilizing scale, adjusting structure, improving quality, strengthening characteristics, and improving level", focusing on planning teacher education, urban and rural construction and human settlements environment services, chemical and biological engineering technology, Six application-oriented professional clusters of information and advanced manufacturing supporting services, cultural creativity, and business services have formed a new pattern of talent training in which the school's professional chain, talent chain, innovation chain, and local industrial chain and value chain clusters are connected, and open and collaborative. The goal and task of building a well-known domestic and first-class high-level application-oriented university with the advantages of teacher education. Combined with the school's goal orientation and the "14th Five-Year" development plan, in recent years, the School of Chemistry and Chemical Engineering has been continuously exploring and constructing the "1234" innovation ability cultivation model, namely, one mechanism, two hands, three carriers, four platforms/four levels/four integrations, focusing on Improve the quality of application-oriented talent training[2].

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3. Strategies for the construction of the "1234" innovation ability training model

3.1. One mechanism, that is, the undergraduate academic tutor system.

Starting from the first semester of freshman year, the college starts the undergraduate academic tutor system, determines its own tutor according to the principle of two-way selection, and completes the academic guidance and career planning during the four-year university under the guidance of the tutor. In particular, students use their spare time, winter and summer vacations, etc., to enter the tutor's scientific research laboratory to conduct horizontal and vertical subject research and second classroom expansion training.

3.2. Grasp with both hands, that is, grasp students with one hand and teachers with the other.

For students, taking the collective creation of the top ten classes as the starting point, they will regularly quantify each class in terms of ideological construction, class construction, social practice, innovation and entrepreneurship and other second classroom construction, and carry out collective evaluation and experience exchange activities for the top ten classes. Through the development of this activity, the effective connection between the first classroom and the second classroom has been realized, and the initiative and enthusiasm of the students to participate in the second classroom has been mobilized.

In addition, for the teaching contribution award, scientific research contribution award, and young teacher growth award set up by the teacher college, when formulating various documents, in addition to assessing the basic business of teachers, teachers guide students to obtain approval for innovation and entrepreneurship projects, win academic competition awards, participate in Appropriate incentives are given to publishing papers, patents, etc. On the one hand, the academic tutor system for undergraduates can truly take root and achieve a healthy operation; on the other hand, teachers are encouraged to incubate research projects into innovation and entrepreneurship, discipline competition projects in advance, so that scientific research can feed back teaching, and build a second classroom and talent training "overpass".

3.3. Three carriers, that is, give full play to the role of the three carriers of the doctoral forum sponsored by the college, one academy, one product, one major, one characteristic series of discipline competitions, and professional associations.

By holding the biweekly doctoral forum of the college, teachers communicate and discuss during the forum, and let the students of the corresponding majors also participate in the forum, so that they can understand the dynamics of the discipline, the academic frontier, and enhance the students' cognition of the major. In addition, the college regularly holds a series of discipline competitions with one product, one major and one characteristic. For example, the current discipline competitions hosted by the college include the College Students' Chemistry Experiment Innovation Design Competition, the Chemistry Interesting Knowledge Competition, and the Teachers' Teaching Design Competition. Through subject competitions, on the one hand, projects can be cultivated for provincial and national competitions, and project libraries can be selected; enhance the comprehensive quality of students. The third carrier is to develop and form professional associations close to the professional characteristics, assign professional instructors to strengthen the construction and business guidance of professional associations, and do a good job in cultivating talents in associations[3].

3.4. Four platforms, four levels, and four integration into the quality engineering improvement work.

At the same time as one mechanism leads, two hands promote, and three carriers are built, the college has been paying close attention to the management of experimental practice teaching in recent years to promote the green and low-carbon development of laboratories. Through regular teaching and research activities, teaching salons, participation in domestic teaching conferences, holding Regular meetings on experimental practice and teaching work, etc., actively demonstrate the optimization and transformation of green experimental projects.

Continuously optimize and transform the verified practice teaching projects, design practice teaching projects, innovative practice teaching projects, and practice training teaching projects involved in the basic, professional, scientific research, and practical training teaching platforms, so as to achieve scientific implementation, Full participation. Through the transformation of green experimental projects, some of the above-mentioned four platforms and four levels of experimental projects are replaced or

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integrated, that is, the combination of micro-experiments and conventional experiments; computer-aided experimental teaching and laboratory practice; Circulate and carry out experimental teaching in series; scientific research projects, excellent cases of subject competitions enrich experimental teaching, etc.

The optimized experimental projects are integrated into various experimental practice courses, integrated into the PPT courseware of teachers' class, integrated into the teaching syllabus, and integrated into the assessment link.

In addition to optimizing the content of experimental projects (table 1), the college actively builds a learner-centered educational ecology, and the experimental practice courses adopt a flipped classroom type and a task-driven type. Mobilize all students to participate actively in the classroom [4].

In addition, some experimental courses also add students' recording of experimental operation videos as small assignments, and this is included in the assessment process as their usual grades.

Table 1: Update the experiment content

Order number	Update the experiment content	Course title
1	Selective synthesis and structural characterization of single and diacyl ferrocene	Organic chemistry experiment
2	Synthesis of chiral indindoline derivatives	Organic chemistry experiment
3	(R) -3.3, -Simple and efficient synthesis of dimethoxy-linked naphthol	Organic chemistry experiment
4	Improvement of Oracetan API	Pharmacological chemistry experiments
5	Optimization and design of the synthesis process of a broad-spectrum anti-cancer drug (entritinib)	Pharmacological chemistry experiments
6	Development of a bacterial cellulose-based antibacterial hydrogel dressing	Polymer chemistry experiment
7	A nanocoating modified lithium ion battery diaphragm	Lithium-ion battery experiment
8	A highly sensitive fluorescence visualization sensor that rapidly detects Zn2 +	Instrument analysis experiment
9	A kind of rapid detection of hypochloric acid content in aquatic products	Analytical chemistry experiments
10	Development of a highly sensitive fluorescence visualization kit for rapid detection of Zn2 + ions	Analytical chemistry experiments
11	Synthesis and application of new polymerization-induced fluorescent materials	Focus on practice
12	Synthesis and properties of fluorescent probe molecules	Focus on practice

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4. The effectiveness of the construction of the "1234" innovation ability training model

The construction of the "1234" innovative ability training model has prompted the college to achieve remarkable results in the training of applied talents in recent years. In the past three years, students have achieved good results in professional discipline competitions, innovation and entrepreneurship training projects, and participation in publishing SCI papers and patents, as shown in Table 2, Table 3, Table 4 and Table 5. In addition, the employment quality and satisfaction of graduates of the college have also been significantly improved, especially the graduate entrance examination rate of 2022 graduates has reached 45%.

Table 2: The Innovation and Entrepreneurship Training Program for College Students approved in 2022

Order number	Project name	Achievement type	Level	Confer department
1	Research and development of a new formaldehyde purification photocatalyst integrating enrichment / catalytic degradation	Innovative training programs	National level	Henan Province education department
2	Design of Zn-P bond-oriented black phosphate heterojunction	Innovative training programs	National level	Henan Province education department
3	Sensing system for mercury ions based on MOF materials	Innovative training programs	provincial level	Henan Province education department
4	A kind of rapid detection of hypochloric acid content in aquatic products	Innovative training programs	provincial level	Henan Province education department
5	Application of cross-linking interpenetrating polymerization strategy in the preparation of highly efficient oil-water separation membrane	Innovative training programs	provincial level	Henan Province education department
6	Research and development of —— new potassium electric anode material	Innovative training programs	provincial level	Henan Province education department
7	Farmland Guard-a highly selective herbicide of chloroamide	Innovative training programs	provincial level	Henan Province education department

Table 3: Awards of the 2022 "Internet +" College Students' Innovation and Entrepreneurship Competition

Order number	The results of the name	The type of results	Win a prize grade	Issue department
1	Biocarbon fiber- -table garbage made batteries, shrimp and crab will show off	Undergraduate Creative Group / The subject track of higher education	First prize	Henan Province education department

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Table 4: The approval of the Outstanding Achievement Award of College Students' Innovation and Entrepreneurship Training Program in 2022

Order number	The results of the name	The type of results	Win a prize grade	Issue department
1	Preparation of catalyst for epoxidation of propylene in slurry bed reactor	Innovative training	Third prize	Henan Province education department

Table 5: Awards of the 2022 College Students' Discipline Competition

Order number	The type of results	Win a prize grade	Issue department
1	"Tianzheng Design Cup" the 16th National College Students Chemical Industry Design Competition	Second prize	Chemical Industry and Engineering Society of China
2	"Tianzheng Design Cup" the 16th National College Students Chemical Industry Design Competition	Second prize	China Chemical will
3	"Tianzheng Design Cup" the 16th National College Students Chemical Industry Design Competition	Second prize	China Chemical will
4	"Tianzheng Design Cup" the 16th National College Students Chemical Industry Design Competition	Third prize	China Chemical will

5. Thinking and Conclusion

In the future, the college will continue to optimize the "1234" innovative ability training model, reduce "theoretical" teaching, highlight the teaching concepts of "learning by doing" and "learning by doing", and train students to comprehensively apply what they have learned through teamwork and group discussions. Basic principles and methods to solve practical problems, optimize students' knowledge structure, improve comprehensive quality, and strive to explore a sustainable development path that cultivates students' innovative spirit and practical ability.

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