

Research on the Reform of Talent Cultivation Model Based on the National College Student Life Science Competition

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Abstract: The National College Student Life Science Competition (NLSC) is an important competition in the field of life science in China. Competition plays a positive role in cultivating students' innovative abilities and promoting teaching mode reform. However, the duration of the competition is relatively short, and most people have not yet effectively improved the quality of teaching through the competition. This article reviews the problems that existed in the early stage of the competition in my unit, including the lack of effective organizational management and supervision system, the lack of a professional guidance teacher team, and the need to improve the training system of the competition team. In the past two years of reform, the author team has taken targeted reform measures to address the above issues, established an effective management system, improved the level of teacher guidance in competitions, optimized the organizational model of the competition team, and created a good competition atmosphere. Through systematic reform, teachers' teaching and research ability and students' scientific literacy have been improved. This article systematically summarizes the reform plan and effectiveness of talent cultivation mode based on life science competitions, and the research results provide reference for the reform of talent cultivation mode in universities.

1. Introduction

The National College Student Life Science Competition (NLSC) is the most large-scale and influential professional competition for college students in the field of life science in China. Since its first session in 2017, it has been held once a year, with the number of participating universities and the number of participants continuously increasing. Statistics showed that in 2021, more than 30,000 students from 430 universities have participated in the competition [1, 2]. The NLSC takes a completely new form of competition. The participating teams design real-world scientific research projects, complete the projects according to the experimental design, and write research papers within about 6 months. The entry process includes team building, writing research background, experimental design, conducting experiments and analysing data (submitting no more than 30 experimental records), writing papers, network expert review, and finals [3]. Therefore, the NLSC

is essentially a talent cultivation mode of project education, and is also a good form of cultivating students' innovative ability [4]. Since the second NLSC-Henan was held, our team has organized teams to participate in the competition for many consecutive years, and has conducted some exploration on how to reform the talent cultivation mode through the competition. This article summarizes the problems encountered during the competition, solutions, and some thoughts, with a view to providing references for educators in the field of life sciences in universities.

2. Main Problems in Organizing Competitions

When the first three competitions were held, there were fewer teams from our college who signed up for the competition. Although there were also award-winning projects, the project quality and award-winning level were still relatively low, which also reflected that there were still some problems in the construction of innovative talent cultivation system focusing on discipline competitions. Through research and discussions, the following problems were identified:

2.1. Lack of Effective Organization, Management and Supervision System

The college lacks an organic integrated organization and management system. The competition is completely organized by teachers and students, and the college has not organized effective guidance and management. This often results in a lack of expert teams, and most projects are limited in technology or innovation. Secondly, due to the lack of unified management, there is information asymmetry between students and teachers. Students who want to participate in the competition cannot find suitable instructors, and teachers who have scientific research projects may not find suitable students, which hinders the effective formation of teams. In addition, inadequate communication between the teams and the college resulted in the College's inability to provide timely and effective financial, technical, management and coordination services. In recent years, there are many teams registered every year, but due to the lack of effective supervision and management, some teams give up every year, which seriously wastes the opportunity of competition and the time and energy of the instructor, resulting in the instructor's enthusiasm for participating.

2.2. Lack of Professional Advisor Team

Most teachers do not have a deep understanding of the guiding ideology, rules and process of the competition, and do not accurately evaluate students' practical ability, which leads to inaccurate grasp of the content and difficulty of the topic selection of the competition, and often results in the inability of the student team to effectively complete all the experiments, which dampens the enthusiasm of students in scientific research training and affects the results of the competition. The lack of communication mechanism among instructors and the lack of effective experience sharing and mutual learning atmosphere is essentially the lack of organic professional teacher guidance team.

2.3. The Training System of the Competition Team Needs to be Further Improved

There is no unified planning for the formation of the competition team, and most of the teams are temporary combinations of the members before the competition registration. Different members have different degrees of experimental skills, which even cannot meet the normal development of the project. The selection and training of participating members should be advanced, and an excellent competition team should be established to give full play to the advantages of the members.

3. The Main Reform Measures for Cultivating Talents through NLSC

In order to meet the requirements of training innovative talents in the new era and cultivate students' innovative ability, scientific research quality and comprehensive ability, the college decided to take the life science competition of college students as the starting point, through a series of reform and help measures, create a strong atmosphere of academic competition, and further improve the quality of professional talent training. The main measures include the following five aspects:

3.1. Establish a Joint Management Team to Serve the Competition

Based on a thorough investigation of the participating teams, a joint management service team was established in 2020 to begin serving the NLSC (2021). The management team includes one leader of the college, who is responsible for coordinating the problems existing in the work of the competition comprehensively, one staff member of the daily affairs management of the competition, who is mainly responsible for the notification of the competition, registration, the schedule of the final, organizing experts to guide the demonstration of the participating projects and other related work. In addition, there is one counsellor, who is mainly responsible for the publicity and mobilization of the competition, and helping teachers and students to build the competition team. One laboratory management staff, responsible for assisting the competition team to coordinate the use of instruments and laboratories, procurement of reagents and consumables for the competition and other security work. Since 2021, through effective management and services, the number of competition registrations has significantly increased. From 2018 to 2020, an average of about 3 teams participated in the competition each year, while from 2021 to 2023, the average number of participating teams increased to 16 per year (Figure 1a). Currently, over 60 students receive systematic research training through NLSC every year (Figure 1b).

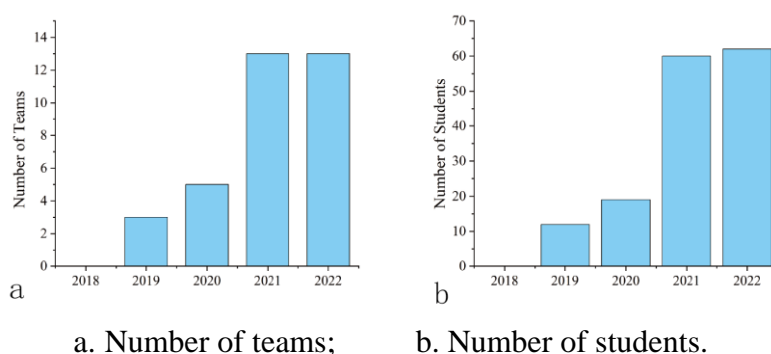


Figure 1: Number of participating teams and participants from 2018 to 2022

3.2. Set up a Team of Experts to Jointly Guide, Evaluate and Supervise the Participating Projects

The proposal demonstration will be carried out before the application of each participating project. The expert group will evaluate the project report, focusing on the difficulty coefficient, workload and innovation of the project, and the excellent projects will be selected for the competition. During the implementation of the project, each team should regularly report the progress of the experiment to the expert team to supervise the progress of the competition in this way, so as to avoid the situation of quitting in the middle of the project due to inadequate supervision. The expert team also provided guidance and training on the experiment preparation,

operation process and standardization of test records during the competition. In 2019 and 2020, 1 team and 3 teams withdrew from the competition due to a lack of guidance and supervision from expert teams, accounting for 33.3% and 60% of the participating teams in that year. Since the intervention of expert teams in 2021, the proportion of teams withdrew from the competition has decreased from 31% in 2021 to 23% in 2022 (Figure 2).

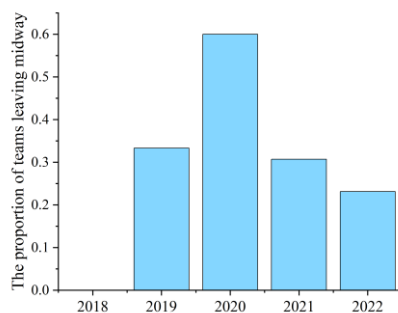


Figure 2: Proportion of teams withdrawing from competitions midway between 2018 and 2022.

3.3. Promote Learning through Competitions and Improve the Level of Teacher Guidance

Organize participating teachers to communicate and learn in other universities, invite award-winning instructors to impart competition experience, and invite competition judges to give lectures. Through the training of guidance teachers, further improve the guidance ability of teachers. Encourage teachers to actively participate in the competition and share their own participation experience. Through a series of measures, the overall guidance ability of the guidance teacher team has been improved.

3.4. Take Multiple Measures to Enhance the Enthusiasm of Teachers and students in the Competition

In order to effectively create a strong academic competition atmosphere, the college has formulated a series of incentive policies. If a teacher guides a student team to win a prize in a competition, the teacher can have priority in applying for a senior professional title. If a student wins a prize in a competition, additional points will be appropriately considered in the scholarship evaluation and various honorary title declarations. In addition, during the re-examination phase of the postgraduate examination, winning the competition will better demonstrate to the judges the systematic scientific research training received during their undergraduate studies. These measures have greatly attracted the enthusiasm of teachers and students to participate in the competition.

3.5. Teach Students according to Their Aptitude and Organize Teams Organically

The implementation of a project often requires multiple experimental techniques, data processing methods, etc. Considering that it is difficult for undergraduate students to master all methods and technologies in a short time, it is necessary to conduct differentiated training based on the characteristics of the members. Each member learns different technologies and methods. During the process of conducting experiments, everyone learns from each other, which can effectively improve efficiency and expand the range of knowledge of students. In addition, it is necessary to pay attention to the grade echelon combination of team members. Members generally take junior students as the main force, while also recruiting and cultivating sophomores and freshmen, which

can continuously cultivate competition members and ensure the continuity of competition. Before 2021, a total of 8 teams participated in the competition, with 31 members all being junior. After 2021, the proportion of junior among team members ranges from 60% to 73%, while the proportion of freshman and sophomore was both between 13% and 20% (Figure 3).

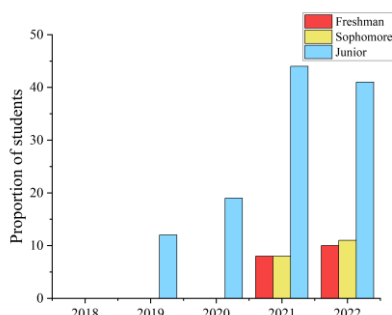


Figure 3: Grade composition of team members from 2018 to 2022.

4. The Impact of NLSC on Teaching Reform and Talent Cultivation Quality

Through systematic reform, the enthusiasm of teachers and students to participate in the competition has greatly improved, with the number of teams participating in the competition increasing to more than 10 each year, and the number of participants exceeding 50. There has also been a new breakthrough in the number and quality of awards awarded by students in the competition. In addition, the competition has greatly promoted teaching reform and improved the quality of talent cultivation.

4.1. Improve Teachers' Teaching Skills

The continuous improvement of teachers' teaching skills is also a career pursuit. However, due to time constraints in classroom teaching, there is insufficient communication between teachers and students, which is detrimental to mutual understanding with teachers and students and improving teaching quality. The participation of students in professional competitions is conducive to the improvement of teachers' teaching skills [5]. During the development of the life science competition, the communication between teachers and students has broken the time and space constraints, and can be carried out online and offline in the after-class time. Teachers have more opportunities to accurately grasp the problems existing in the learning process of students, further improve the teaching quality and complete the distillation of their own teaching skills through teaching content adjustment, teaching method reform, and other forms.

4.2. Teachers and Students' Satisfaction with Teaching Quality has Significantly Improved

In traditional classroom teaching, students passively accept teaching content and have low learning enthusiasm. After participating in the competition, students' learning style becomes active, and they are eager to learn the basic biological principles included in the competition experiment, understand the standard operating procedures and precautions of the experiment, and understand the cutting-edge research progress in the field of concern [6]. Therefore, in the process of classroom teaching, students learn with purpose, and their enthusiasm is greatly improved. Especially in experimental teaching and practical teaching activities, students actively request repeated practice, strictly follow operating standards, and systematically train experimental operating skills. Research shows that teachers and students have significantly improved their satisfaction with teaching quality

in the past two years.

4.3. Creating a Strong Atmosphere for Teaching Reform and Research

The development of the competition has stimulated the enthusiasm of teachers for teaching reform [7]. In order to further enhance the effectiveness of the competition, teachers have made corresponding reforms to the classroom teaching content, including the introduction of cutting-edge scientific research results, the introduction of the latest experimental technology, and even the compression and expansion of the teaching content. In the past two years, there have been new breakthroughs in the application of teaching reform projects and the publication of teaching reform papers.

4.4. Improve Students' Team Awareness

Driven by competition, students' enthusiasm for learning has greatly improved, and the collective learning atmosphere based on teams has become more intense [8, 9]. Driven by common experimental purposes, team members seek information and discuss together to achieve specific experimental purposes. In the process of learning, not only has scientific and cultural literacy been improved, but more importantly, team awareness has been cultivated.

5. Conclusions

As an organizer and participant, the authors summarized the problems faced by the college organization in participating in NLSC and participated in the reform of talent cultivation mode based on NLSC. Through a series of reform measures, more students have been attracted to participate in NLSC and carry out systematic research training. In addition, NLSC has further promoted the reform of teaching models and improved the quality of talent cultivation.

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