

An Integrated Teaching Mode Incorporating Contest, Teaching, and Learning

—Taking the 3DDS Contest as an Example

Ruhe Zhao*

Intelligent Manufacturing College
Jincheng College of Sichuan University
Chengdu, Sichuan, 611731, China
504470512@qq.com

Xian Liu

The Urban and Resource Department of Science College
Tibet University
Lhasa, 850000, China
3474180093@qq.com

Cong Li

Intelligent Manufacturing College
Jincheng College of Sichuan University
Chengdu, Sichuan, 611731, China

Sanyan Li

Intelligent Manufacturing College
Jincheng College of Sichuan University
Chengdu, Sichuan, 611731, China

Abstract—In order to solve current problems existing in mechanical drawing courses, such as abstraction, difficulty in learning, low enthusiasm and strong sense of frustration in the process of learning, the integrated teaching mode incorporating contest, teaching and learning has been adopted. It determined the knowledge and abilities that students need to master based on the talent training objectives before the contest. It also established student teams and faculty teams to hold learning contests and skill contests in theoretical and practical classes, and introduce 3DDS contest in the stage of knowledge application. As a result, students fully mastered relevant skills and knowledge of mechanical drawing and completed 131 innovative works, and teachers published 14 academic papers. This work divided the contest into three dimensions: theory class, practice class and 3DDS contest, and two levels: school-level as well as provincial and municipal level. Finally, it proposed a new integrated teaching mode incorporating contest, teaching and learning.

Keywords—educational innovation; "promoting learning by contest"; curriculum reform; 3DDS contest; applied undergraduate

I. INTRODUCTION

At present, there are some problems in the mechanical drawing teaching of applied engineering subjects. First, the mechanical drawing is monotonous at present, for example, the mechanical drawing course emphasizes the normalization and standardization of lines and pictures, and emphasizes the standard of drawing. At the same time, the curriculum reform compresses class hours from 200 hours to 96 hours, as a result, this traditional teaching method that emphasizes the quality of the picture has discouraged many entry-level students. In addition, employers pay attention to the quality of students, their ability to learn and their plasticity. In the field of mechanical drawing, they pay attention to the expression of ideas, sketches, axial side drawings and three-dimensional graphics, since enterprises have basically eliminated the means of board drawing.

Second, although current teaching has carried out MOOC, flipped classroom and other projects, there is still not much teacher-student interaction, and students have few opportunities to brainstorm, communicate and practice. After the completion of the course, students even cannot complete a project independently. Students are unable to understand product design, market segmentation and product promotion. Consequently, the product design completed by students is almost completely out of the market. Third, the current manufacturing industry is developing very rapidly, and many new technologies, new materials, new control methods and strategies have emerged, so the classic theories and methods of the past are constantly being subverted. However, the existing textbooks are updated slowly, usually 5-10 years behind the industry [1-2]. In response to these problems, 3DDS contest is introduced. The integrated teaching mode incorporating contest, teaching and learning combines theory with practice and learning with contests, and trains students to "learn by doing" and "do by learning", which has obtained good results after 6 years of operation.

II. CONNOTATION OF THE INTEGRATED TEACHING MODE INCORPORATING CONTEST, TEACHING, AND LEARNING

A. Connotation of "promoting learning by contest"

Generally speaking, "promoting learning by contest" is to design a lot of contest links in the process of learning, so as to stimulate the enthusiasm of students to learn through contests. It takes advantage of the competitive characteristic of young students to give full play to the personality of young people who do not give up, so as to create a positive learning atmosphere. Through contests, students can focus their attention, put down their mobile phones, and get into the contest. Whenever students encounter problems during the contest, they can immediately think positively or discuss with their teachers and classmates, and they can also access relevant information. In this way, students combine theoretical

classroom with practical classroom, and their practice ability, thinking ability and communicating ability have been greatly improved. The most important point is that students can cultivate a beneficial habit to solve problems by themselves and improve their self-confidence [1-3].

In practice, it is to achieve three dimensions of the contest. First, carrying out the method of "promoting learning by contest" in the theoretical class, in which students compete with each other in terms of pre-class preparation. When taking classes, they compete who teaches better in terms of flipped class and who understands knowledge better. Second, laboratory contest, which is a competition on practice ability and project skills. Third, encouraging students to participate in the 3DDS competition. This comprehensive project contest can exercise individuals as well as teams. In this process, the reorganization of talents training programs can also be completed, which links the training program to the competition tightly.

B. Connotation of "promoting teaching by contest"

"Promoting teaching by contest" means that contests promote changes in teaching methods and progress of teachers. Teachers need to constantly learn advanced design concepts and constantly update their knowledge. In the process of participating in the contest, instructors should have a solid foundation of professional knowledge and skills, so that they can guide students to participate in high-level academic competitions. For example, in the 3DDS contest, teachers should not only have professional knowledge and skills related to mechanical drawing, mechanical principles, mechanical design, manufacturing process, AUTOCAD 2D drawing, UG 3D design, product design and appearance design, but also keep up with the changes of the times, master the knowledge of smart home, artificial intelligence, Internet of Things and other fields. What is more, the syllabus should be redesigned, emphasizing the curriculum design and classroom design, so that the personnel training plan, syllabus and other guiding documents can adapt to the current mode of promoting learning and teaching by contest and integrating teaching with learning [2-4].

C. Connotation of "integrating teaching with contest"

"Integrating teaching with contest" is to integrate contests and practice platform with teaching deeply. The traditional teaching attaches importance to the theoretical classroom but despises the practical classroom. Through the contest, practical teaching and theoretical teaching can be combined. Teaching forms related to the contest mainly include visiting and studying in enterprises and institutions, hiring industry experts to carry out various special lectures, incorporating the 3DDS contest into the curriculum design, and carrying out campus trials and special contests, such as the "Internet +" competitions and entrepreneurial competitions, which will be included in the course credits calculation. Guided by professional teachers, students will complete case study, social practice and other projects [5-6].

III. INTRODUCTION OF 3DDS CONTEST

The full name of the 3DDS contest is "3D Design Show", a contest initiated by 3D Power in 2008 featuring innovative design and digital design, which is to promote the integration of the real economy and the digital economy. It aims to promote teaching by contests, promote application by contests and promote innovation by contests. In 2019, the Ministry of Education included the 3DDS contest into the project competition funded by the Ministry of Education.

The participating units of the 3DDS contest cover 550 colleges and universities and 900 companies. So far, more than 7 million people have participated in this contest, and more than 150,000 excellent players have been honored. It has become one of the innovative design events with the highest level, the most extensive coverage and the greatest influence in China. The 3DDS contest is recognized by the China Association for Science and Technology, the Ministry of Industry and Information Technology, Ministry of Science and Technology and the Ministry of Education. Especially after being recognized by the Ministry of Education, teachers and students of colleges and universities actively participated in the 3DDS contest. In 2014, Jincheng College of Sichuan University actively participated in the 3DDS contest. Students submitted 131 innovative works in total, 60 of which were recognized by judges and won awards. Students also benefited a lot from the contest.

The 3DDS contest includes open autonomous propositions and industry hot-spot propositions. The autonomous proposition includes digital industrial design competition, digital habitat design competition and digital culture design competition. The main propositions of the digital industrial design competition include industrial design and product design, electrical and mechanical engineering structure design, mold design, digital engineering design, engineering analysis and others. The main propositions of digital habitat design include digital city and planning design, BIM design, indoor and outdoor performance design, smart home design and others. The digital culture design category mainly includes game design, digital tourism design, digital art design and new media art design.

Students at Jincheng College of Sichuan University are mainly concentrated in the digital industrial design competition, providing innovative mechanical and electrical products, concepts or digital designs.

IV. ORGANIZATIONAL GUARANTEE AND SYSTEM CONSTRUCTION OF "PROMOTING LEARNING AND TEACHING BY CONTEST"

Carrying out the integrated teaching mode incorporating contest, teaching and learning requires a team of highly skilled and experienced teachers. More than 80% of the teachers in Jincheng College of Sichuan University are double-qualified teachers from enterprises, who have rich work experience. They are all master's degrees or above with CMM certification certificate, robot certification certificate, digital processing and design certification certificate, which is the premise that the contest can be well guided. What is more, the university has established a system to encourage contests, which ties

contests to teachers' year-end evaluations. The first prize of a provincial 3DDS contest can be converted into 30 hours of teaching workload, see Table 1 for details. The perfect system is the system guarantee of "promoting learning and teaching by contest". It also encourages school-school association.

Sichuan University and Tibet University also conducted "Internet +" competitions to better integrate the contest into all stages of teaching, and they also set up a virtual simulation laboratory to conduct regular academic report exchanges and activities.

TABLE I. WORKLOAD CONVERSION TABLE OF THE CONTEST

Level Workload	First prize in provincial and municipal contests	Second prize in provincial and municipal contests	Third prize in provincial and municipal contests	First prize in national contests	Second prize in national contests	Third prize in national contests
Teaching hours	30	20	10	120	60	30

V. "PROMOTING LEARNING BY CONTEST" - TAKE THE 3DDS CONTEST AS AN EXAMPLE

"Promoting learning by contest" is divided into three stages: the preparation stage, the promotion stage and the competition stage. The preparation stage includes the process of objective design, topic selection and team formation. The objective design is to determine the target and topic of the contest based on the training objective, the requirements of the talent training program, and the knowledge and skills required by the syllabus. The goal is to train students to master the design software such as AUTOCAD or UG to complete 3D design of mechanical and electrical products, assemble and motion simulation. Team formation needs to establish two teams, one is the student competition team and the other is the teacher team. The student team builds interest groups according to the needs of work and students' interests, and they encourage each other, cooperate and discuss during the process of learning.

In the second stage, theoretical study competitions should be conducted in the process of theoretical courses such as mechanical design, mechanical principles, theoretical mechanics, material mechanics, and computer-aided design CAD. Students can compete who previews better, speaks better and master knowledge better. In the actual operation stage, students compete with each other in terms of actual design drawing skills.

The third stage is the formal contest stage, which is divided into school-level, provincial-level and national-level. Students who participate in the provincial and national contests must be the winners in the school-level contests. Through this competition, students can fully explore their potential and learning enthusiasm. Students are always in a positive and upward state, which is conducive to the cultivation of good psychological quality and practice ability. At the same time, students can turn to teachers for help or discuss with classmates as soon as they encounter problems during the contest, so that they can not only master the knowledge, but also exercise the ability to express, cultivate independent thinking, and train cooperative ability.

In the whole process, teachers are both instructors and coaches. Teachers should sum up the gains and losses in time after the contest and promote their professional level. The detailed process is shown in Fig. 1.

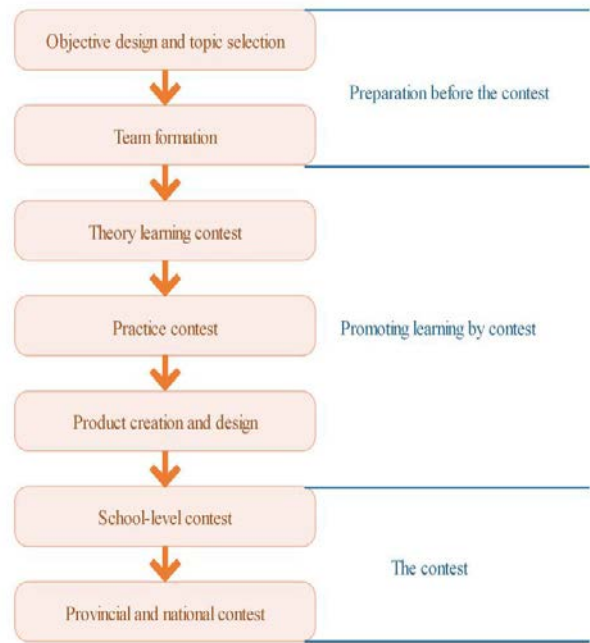


Fig. 1. The Execution Mode of "Promoting Learning by Contest"

VI. ACHIEVEMENTS OF "PROMOTING LEARNING AND TEACHING BY CONTEST"

In the process of "promoting learning by contest", the university has achieved good results. In the 3DDS contest, the university gets 4 national first prizes, 8 second prizes, 15 provincial first prizes, 20 provincial second prizes and 25 provincial third prizes. More than 240 people are honored in the contest due to their design of new energy vehicles, bicycle nests and automatic barbecue machines. In addition, teachers' professional ability has also been improved to a certain extent. Teachers publish 14 related academic papers and harvest 60 teaching materials with certain value, including more than 180 minutes of 3D assembly and animation video. See Table 2 for details.

TABLE II. ACHIEVEMENTS OF THE 3DDS CONTEST FROM 2014 TO 2019

Level Project	First prize in national contest	Second prize in national contest	Third prize in national contest	First prize in provincial contest	Second prize in provincial contest	Third prize in provincial contest
2014-2019	4	8	7	15	20	25
Number of people	16	32	28	60	80	100

VII. REFLECTION ON THE MODE OF "PROMOTING LEARNING AND TEACHING BY CONTEST"

"Promoting learning by contest" has been conducted in China for 9 years, and it has been successfully applied in Jincheng College of Sichuan University for 6 years. In terms of training engineering talents, there are some problems existing in the practice.

First, students who benefit the most are those who are better in classroom theory teaching and experimental teaching. By contrast, students in the middle and below in the theoretical and experimental classrooms progress little. How to make these students get more gains in the process is a problem faced by educators.

Second, in the process of "promoting learning by contest", some people only pay attention to the results of the contest and they only care about the awards. Consequently, they pay no emphasis on participation and progress, and some students even give up as soon as they don't have a chance to win the prize.

Third, at present, the essence of "promoting learning by contest" is to increase the educational attention and investment for some participating students. Its essence is one of the "elite" educations in the new era. How to ensure the fairness of educational resources and how to change education into a real mass education is a difficult problem.

Fourth, the current curriculum system follows the traditional training model and the system of engineering talents. In the context of "promoting learning by contest", the talent training mode and curriculum system need to be changed to adapt to this trend and change.

VIII. SUMMARY

This work summarized the integrated teaching mode incorporating contest, teaching, and learning. This new teaching mode has achieved good results in the mechanical drawing course of the intelligent manufacturing college. More than 1,200 people participate in the contest, and 240 of the winners participate in the 3DDS contest, creating 60 valuable projects. The students' learning enthusiasm and learning potential are tapped. Teachers have published 14 academic papers. The practice has proved that it is feasible to implement the integrated teaching mode incorporating contest, teaching and learning, which has certain promotion value and reference value for training application-oriented talents in the new era.

REFERENCES

- [1] Chen Mengji. The Mode of "Promoting Learning and Teaching by Contest" - Taking the Mechanical Science Contest of Hechi College as an Example[J]. Contemporary Educational Practice and Teaching Research: Electronic Edition, 2017(9): 96.(In Chinese)
- [2] Yang Hui. The Application of TRIZ Innovation Principle in Architectural Modeling Teaching[J]. Journal of Higher Education, 2017, 26 (2): 70-75. (In Chinese)
- [3] Chen Qiang et al. The Expansion of TRIZ Theory Standardization Problem Solving Process and its Application in Atmospheric Chemistry Teaching[J]. Journal of Higher Education, 2019, (14): 71-74. (In Chinese)
- [4] Shen Qi. Research on the Current Situation of "Promoting Learning and Teaching by Contest" in Higher Vocational Colleges[J]. Culture and Education Materials, 2018(24): 205-206. (In Chinese)
- [5] Xie Jinqiang, Fu Liru. Exploring the Active Practice Teaching System of the Integrated Teaching Mode Incorporating Contest, Teaching and Learning[J]. Heilongjiang Education, 2017(7). (In Chinese)
- [6] Zhong Denghua. The Connotation and Action of New Engineering Construction[J]. Research in Higher Education of Engineering, 2017(3): 10-12. (In Chinese)