

# Course Construction of “Knitting” under the Background of New Engineering

Jinfeng Wang<sup>1</sup>, Weilai Chen<sup>1,\*</sup> and Ming Weng<sup>1</sup>

<sup>1</sup> *College of Textile Science and Engineering, Zhejiang Sci-Tech University, Hangzhou, Zhejiang, 310018, China.*  
*\*Corresponding author. Email: ewai193@zstu.edu.cn*

## ABSTRACT

Under the background of new engineering education, the teaching reform of the "knitting" course was carried out in several aspects. The teaching content combines art and engineering, theory and practice. Besides, it incorporates new knitting technologies, new processes, new applications, and results of scientific researches. During the teaching process, interactive teaching mode of "active classroom" was adopted, and the off-campus practice bases were taken full advantage of. The practice of the course reform showed positive effects in cultivating knitting design talents with strong innovative capabilities to meet the requirements of the textile industry in Zhejiang.

**Keywords:** *New Engineering; Subject Knitting; Active Classroom; Combination of Art and Work*

## 1. INTRODUCTION

The concept of engineering education professional certification has reached a consensus in the field of higher education all over the world, which is an inevitable trend of engineering education in the new era. A pilot project for professional certification of engineering education was started in China in 2005. After 10 years of development, China formally became one of the 18th official members of the Washington Agreement, an international undergraduate engineering degree mutual recognition agreement on June 2nd, 2016. In order to promote the reform and innovation of engineering education, the Ministry of Education has actively pushed the construction of new engineering disciplines, and formed the "Fudan Consensus", "TianDa Action" and "Beijing Guide" in February, April and June, 2017. New engineering construction is a strategic action to actively respond to a new round of technological revolution and industrial transformation. It is a new economic requirement characterized by new technologies, new industries, new business forms and new models, a series of national major strategic implementation requirements, industrial transformation and upgrading, the requirements for the conversion of new and old kinetic energy, as well as the requirements for enhancing international competitiveness and national hard power. The construction of new engineering disciplines presents the characteristics of "five new", namely, new structure, new quality, new concept, new system and new model. Its connotation construction includes not only the upgrading and transformation of traditional engineering disciplines and interdisciplinary, but also the active layout and innovative development of emerging engineering disciplines.

Textile industry, as China's traditional pillar industry and an important civilian production industry, has been given by the new era the new characteristics of "creating new

advantages in internationalization, fusion of technology and fashion, and simultaneous use of clothing and industry", presenting "new technology and new industry". Therefore, it is necessary to explore the training system of textile professionals under the background of "new engineering" based on the current situation of professional talent training, and develop new engineering construction for textile engineering.

The course "Knitting"[1-3] is a compulsory course for textile engineering majors. It mainly introduces the basic principles and methods of modern knitting engineering; the basic organization and knitting principles of weft knitting (circular knitting machine, flat knitting machine) and warp knitting; principles of fully formed knitted fabrics; knitting technology, organization and knitting principle of industrial, intelligent and new knitted products[4-5]. Through the theoretical and practical teaching of this course, students will be able to understand the basic tasks of each process of modern knitting engineering, new technology, new equipment, new crafts of modern knitting engineering. Also it enables students to master the necessary theoretical knowledge and practical skills for knitted fabric design and design research. The core concept of engineering education professional certification is integrated into the teaching process of this course. Education and teaching system of interdisciplinary with integration of production is constructed.

In the new training plan, the number of teaching hours has been greatly reduced. How to effectively use classroom time to strengthen learning efficiency and effectiveness has become the main concern. "Knitting" is facing with problems such as rapid development of knitting technologies, the need of updating original teaching contents and updating of laboratory equipment, which needs to be solved by the reform.

## 2. COURSE INTRODUCTION

### 2.1. Course Content

"Knitting" is a course that combines theory and practice, textile engineering technology and art[6-7]. The content of the course is closely related to knitting technology, organizational design, and intelligent manufacturing under the background of modern new engineering. It requires students to integrate knitting technology and mathematics, mechanics, patterns and colors. Therefore, the comprehensive application of knitting technology, mathematics, mechanics, fabric pattern and color is the difficult point of this course.

Our school has opened a knitting major in 1987, and which is in a leading position in China. This course has a long history and is one of the traditional courses of our school. The teaching content combines art, engineering, theory and practice, integrates new technologies, processes and applications in the direction of knitting, which integrates scientific research results into the teaching content. It adopts the interactive teaching mode of "active classroom", and fully gives full play to the role of off-campus practice bases to cultivate knitting design talents with strong innovative capabilities for the textile industry in Zhejiang.

### 2.2. Course Objective

The main training objectives of this course are:

- (1) Improving students' understanding and mastery of comprehensive knowledge of knitted fabric technology
  - (a) Improving students' comprehensive knowledge of knitted fabric technology, understand the appearance characteristics, design methods and production processes of knitted fabrics;
  - (b) Focusing on mastering the basic organization and knitting principle of weft knitting (circular knitting machine, flat knitting machine) and warp knitting, understanding the basic tasks of each process of modern knitting engineering; understanding the new technology, new equipment, new technology of modern knitting engineering, and so on;
  - (c) Focusing on mastering the principle and knitting process of fully formed knitted fabrics, mastering the formulation of knitted product process flow and the determination method of each process production process;
  - (d) Being familiar with the organization and knitting principle of industry, intelligence and other new knitting products; understanding the cutting-edge technology and development trend of knitting engineering; being familiar with the basic process of research and development of new technologies, products, processes and equipment;
  - (e) Mastering the latest new materials, new processes, new technologies, new equipment and other product design information related to knitted fabrics.

### (2) Ability target

Through the study of this course, students should acquire the following abilities: being able to independently retrieve professional information and new technology, new process information related to knitted fabrics; mastering the integrated design principles, design methods of knitted fabric organization and knitting process "process combination"; being accurately analyze the characteristics of the knitted fabric structure.

### (3) Quality goals

Through the study of this course, students should pay attention to the cultivation of the following qualities: good moral sentiment, strong sense of social responsibility, independent personality pursuit, diligent thinking and in-depth research habits; good aesthetic analysis ability; strong independent learning ability, active exploration and independent thinking in new knitwear technology; combining theory with practice, art with science and technology; and good product design, process technology and management capabilities.

## 3. TEACHING REFORM AND PRACTICE

### 3.1. Teaching Reform Methods

OBE (Outcome-based education), also known as ability-oriented, goal-oriented or demand-oriented education. Organizes, implements and evaluates the structure of education based on expected learning output. Its core concept is "student-centered, output-oriented, continuous improve". Emphasizing the learning results obtained by students through the educational process. The theoretical knowledge, practical skills, problem-solving methods and innovative thinking acquired by students are all learning results. OBE requires educators to have a clear idea of the ability that students should achieve when they graduate, and "reverse design" educational activities based on the training goals to ensure that students achieve the expected goals.

In order to achieve the purpose of enabling students to deeply and comprehensively understand the content of the course, a combination of theoretical teaching and practical teaching is adopted in the teaching process. After students have a preliminary understanding of the basic principles of process technology, they can visit the laboratory or factory through intuitive experience to deepen the understanding of theoretical knowledge. At the same time, integrate scientific research results into the teaching content to enable students to further understand the scientific principles behind the technology and understand how scientific knowledge creates productivity.

In order to allow students to understand and master the organization and knitting methods of knitted fabric design, theoretical teaching is used as the basis in the teaching process, combined with design examples to analyze and practice methods. According to the development of knitted

fabrics, new technology and new process trends, we will extract the latest knitting organization and knitting information from the market, trading companies, and the Internet. We also introduce the knitting pattern, color, organization, density, fineness and other process parameters of the new knitting technology. Mobilize students' active participation in learning subjective initiative; cultivate students' actual design ability, innovative spirit, and the ability to research new technology and new technology of knitted fabrics. In the teaching methods, it is very important to use the combination of multimedia modern networked teaching methods and PPT, video and other multimedia teaching. The teaching method of product analysis and practice base enterprises is very important. Through multimedia design example teaching and analysis practice, the theoretical teaching of the course is closely linked with production practice. Teachers are easy to teach, students love to learn, and are linked with the needs of the knitting industry to achieve good teaching results.

### **3.2. Teaching Reform Scheme**

This course is composed of six professional course teachers. The main reform plans include five aspects: optimizing the team of course teachers, optimizing course design, enriching course teaching resources, reforming teaching methods, and reforming teaching assessment methods. The specific contents are as follows:

#### *3.2.1. Optimizing the course teaching team*

Teachers play an important guiding role in teaching, and their professional knowledge and teaching style has a significant impact on teaching quality. To do a good job in the construction of high-quality courses and in-depth teaching reform, the key is to have a high-level faculty and form a relatively stable, united, rationally structured teaching echelon with development potential. Team members have their own strengths in the field of knitting disciplines and have a reasonable echelon of knowledge.

The age of the members of this course group is between 30 and 56 years old, and they have a good age level and knowledge structure, theoretical foundation and practical experience. However, because this course involves a wide range of knowledge and engineering practice, it requires the cooperation of multiple teachers to organically integrate all aspects of knowledge to enhance the teaching effect. To this end, in the optimization of the teaching team of this course, the following work is carried out:

- (1) Improve the quality of teachers and strengthen their professional skills. Each teacher always pays attention to the frontier of new knitting technology and new product development, and to the vertical and horizontal professional knowledge Development;
- (2) Formulate perfect training measures for young teachers. For each young teacher, an old teacher is arranged as an

instructor, mainly to guide and cultivate the professionalism of young teachers, improve teaching level and professional ability;

(3) Develop talent exchanges. Strengthen the construction of the teaching team, carry out international exchanges, and enhance the international vision of teachers;

(4) Improve the operating mechanism and incentive mechanism of the research group, strengthen the learning and communication between the research group members, organize mutual lectures, carry out teaching and research activities on teaching topics to promote the team, improve the structure and level.

In short, in the course of course construction, strengthen the training of young teachers, strengthen teaching activities, improve the overall teaching quality of the course and the overall teaching level of team members through mutual lectures and experience exchanges.

#### *3.2.2. Optimizing curriculum design*

As a professional course for textile engineering students, "Knitting" has many problems, such as a few hours, many and new teaching contents. It is an urgent problem that how to impart knowledge about the huge number and variety of knitting technology, fabric structure, knitted fabric and its industrial use, functional and intelligent products to students within a limited number of hours. To solve this problem, teachers need to establish a complete curriculum system structure, in-depth grasp and optimize the design of the curriculum content, use appropriate teaching methods and methods in the teaching process.

##### 3.2.2.1. Modification of curriculum teaching system

To improve the structure and content of the curriculum teaching system, modification of the curriculum teaching system is made. The traditional teaching system of knitting courses is usually divided into two parts: one is to explain the knitting and weaving process; the other is to explain the structure of fabric classification. On the basis of combining the above two points, this course reintegrates the teaching system structure of the course. It will introduce the knitting principle and technology/ equipment (such as warp knitting machine, weft knitting machine and computerized flat knitting machine) and fabric organization structure. At the same time, the curriculum teaching system is expanded and improved, explaining the latest knitting technology and equipment (such as full-forming equipment and technology), the latest industrial knitwear, functional and intelligent knitwear. With "equipment-technology-fabric structure-fabrics/products" as the main line, teaching work is carried out step by step with the knowledge of "knitting principle-fabric structure design, structural characteristics-product characteristics and applications". The teaching content of the latest knitting technology, industrial and smart knitwear is relatively independent, and the learning sequence can be flexibly mastered.

On the basis of the course textbooks, add supporting knitted fabric organizational structure textbooks, new knitting technology videos, new technology, new product information, well-known universities and corporate websites, related research documents.

In the course teaching, the use of multimedia teaching, combined with video, animation, photos and real objects, strengthen students' intuitive understanding of knowledge points, improve students' understanding and imagination.

### 3.2.2.2. Emphasis on innovation

Based on the forefront of disciplines, pay attention to innovation. "Knitting" teaching needs continuous innovation to adapt to the new situation and scientific progress. The members of the research team study continuously, read the literature related to the major, participate in academic activities, actively participate in scientific research and teaching research, keep abreast of the development trend of the discipline, grasp the latest results, summarize and organize them. In order to introduce the latest frontier developments in the field to students when teaching, guide students to pay attention to the development of these new achievements and new technologies at any time, stimulate students' interest in learning, and improve students' self-learning ability.

### 3.2.2.3. Standardizing the teaching process

The teaching process is standardized to establish a curriculum teaching implementation plan and use the curriculum learning guidebook. In order to be able to effectively improve the quality and effect of course teaching, and to realize the construction goals of this project, a detailed course teaching implementation plan and the use of course learning guide manuals are established to ensure the smooth progress of the teaching process. The curriculum teaching implementation plan mainly includes six parts: the preparation of teaching documents, the implementation of classroom teaching, homework and guidance, the setting of discussion courses, the reading of research papers and the course assessment:

(1) Preparation of teaching documents.

The formulation and improvement of lecture notes/examination question bank/teaching documents for teaching is an important part of this link, including teaching courseware, outlines, exercise bank, test question bank and teaching handouts, and so on, which is used to standardize the theoretical and discussion sessions of the course;

(2) Classroom teaching implementation.

This course has a total of 32 hours and is divided into 16 weeks. Six teachers are responsible for teaching, and each teacher is responsible for 4 to 8 hours to ensure timely correction of homework, adequate answers to questions, and barrier-free communication with students.

(3) Homework and tutoring after class.

After each chapter is finished, a certain number of after-school exercises will be arranged for students to consolidate and improve. In the Chaoxing Learning Tong APP, students are provided with standard answers to the after-school exercises in time, collectively answering questions about common errors in student homework, and providing individual guidance to individual students with weak foundations.

(4) Setting of practical courses. In the sixth and seventh weeks of teaching, students will be arranged to teach practical courses in the knitting laboratory, so that every student can experience and be familiar with knitting equipment, technology, fabrics and products.

(5) Reading research papers. Select 2-4 articles about the latest developments, reports and reviews in the field of knitting equipment and products, and recommend them to students as extracurricular reading materials, and ask students to discuss in groups as extracurricular homework and include them in the usual assessment results.

(6) Course assessment. The final course assessment score is mainly composed of two parts, of which the usual score accounts for 40% of the total score, and the final paper score accounts for 60% of the total score.

### *3.2.3. Enriching curriculum teaching resources*

Most of the teaching content of "Knitting" course has been determined very early. However, how to impart knowledge to students in an efficient, suitable way and method, and at the same time expand relevant professional knowledge, combined with the ever-changing new technologies and products, has always been the driving force for the members of this research group to carry out high-quality curriculum construction and reform. In the early teaching process, the course team has tried teaching methods such as PPT courseware, network courses, case teaching, project teaching. It has achieved good teaching results. In this project, facing the needs of economic and social development, aiming at the forefront of professional development, relying on modern information technology, focusing on the effective application of network resources, it includes: providing students with effective links to the knitting teaching videos of well-known universities at home and abroad, for students to learn reference. Introduce relevant authoritative websites and databases to students, so that students can understand and master the latest developments in the field. Establish the Chaoxing Learning App online course, and release the answers to the exercises after class with the lecture PPT in time for students to review and improve. In short, this topic will use the Internet as a carrier, classrooms as a platform, laboratory teaching and corporate visits as supplements. Make full use of effective resources on the Internet to enrich teaching content.

### 3.2.4. Reforming teaching methods

Due to the characteristics of knitting, such as more content, fewer class hours, and strong practicality, teaching methods can be reformed to promote students' learning and stimulate students' learning potential. It is proposed to adopt a combination of theoretical teaching and practical teaching, a combination of scientific research and teaching mode.

In the course teaching, the student's main body status is emphasized, and the actual learning effect of the students is regarded as the goal of course teaching. Through classroom communication, enhance student participation. By rationally designing coursework, guiding students to learn independently, and promoting students' participation in the entire course of learning through homework reports and periodic assessments, teachers will adjust the course content and teaching methods in a timely manner based on student feedback. Strengthen the cultivation of students' independent learning ability, so that the ratio of students' study time inside and outside class reaches 1:2.

### 3.2.5. Reforming assessment methods

The new assessment method aims to improve students' academic evaluation methods, increase the monitoring, assessment and feedback of learning effects in the teaching process. It is a new method that combines knowledge assessment and ability assessment. It takes daily speeches(10%), discussions(10%), Attendance(10%) and homework(10%) as normal results. The usual scores will account for 40% of the total test scores, and the final exam scores will account for 60% of the total scores. The method transfers students' focus from the final scores to the learning process, and promotes students to master the basic theories and methods of Knitting. The reasonably designed assessment method reasonably evaluates students' knowledge and ability levels, and provides constructive opinions on curriculum development based on the assessment results.

## 4. CONCLUSION

The practice of the reforms proposed in this paper showed positive results mainly in the following three aspects:

Firstly, the teaching team of knitting courses was optimized. The teaching team was optimized according to the characteristics and development trends of knitting technology and product knowledge, the level of curriculum construction was raised, the structure and level of the teaching team were improved. At the same time, the team gradually grew during the course construction, accumulated rich teaching resources, experience and abilities.

Secondly, abundant online teaching resources have been established. Digital network teaching resources were constructed to realize course sharing. The construction of

basic teaching resources on the Internet was updated and improved, the electronic teaching plans and multimedia system courseware of relevant courses were modified according to the latest technology and industry trends, the uploading of teaching videos of relevant courses was completed. The construction of auxiliary teaching resources was updated and improved, and courseware was uploaded matching design materials; actual operation video courseware was made to match the courseware, which is more intuitive and effective for students to understand the course content.

Finally, curriculum construction was adapted to the development of new engineering. The construction of this course was student-oriented, with the goal of new textile industry and new economy, and cultivated compound advanced engineering with both textile engineering innovative thinking and international vision of knowledge, ability and quality, technical personnel.

The experience of the reform can be applied to other textile speciality courses under the new engineering situation.

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