Construction of the "Identical Fusion" Relationship Between Garment CAD and Core Professional Courses Under Background of Engineering Certification

Ziwei Huang, Shaohong Lou

Art Institute, Hubei Polytechnic University, Huangshi, 435003

Abstract: At present, there are two outstanding problems in the teaching of garment CAD in colleges and universities: one is missing of parametric structure design function for garment CAD teaching software, the other is disconnection between garment CAD and core professional courses. From the perspective of talent development and industry demand, teaching reform is proposed: first of all, the curriculum of garment engineering drawing is established to introduce the general AutoCAD software for engineering majors. Secondly, under the framework of "identical fusion" relationship, the curriculum group is constructed, which contains two-dimential and three-dimential garment CAD, garment structure design, together with garment technology. The reform mode has shown good teaching effect in practice.

Keywords: Garment CAD；Garment structure；Parametric structure design；Garment technology; Curriculum group

In recent years, the phenomena of "quick response to small orders" and "clothing customization" have appeared in garment industry, which puts forward new requirements for the garment CAD and 3D modeling, data processing for intelligent pattern and comprehensive practical ability for professionals[1]. On the other hand, the cultivation of the ability to deal with complex engineering problems with modern tools is one of the core target of fashion design and engineering major. Therefore, the connotation construction of core professional courses should be carried out urgently with garment CAD taken as the starting point.

1. The disadvantages of "successive independent" relationship

At present, in colleges and universities, most teachers of garment structure courses have realized professional software drawing and multimedia teaching. They believe that the teaching purpose of garment CAD course is to grading and marker making. Garment CAD course is a follow-up course of garment technology course[2]. A few older teachers of garment structure courses teach by way of manual drawing and blackboard writing. They generally believe that garment CAD is an extension of garment structure course[3], which aims to change the traditional manual structure drawings into computer drawings. Garment CAD course is generally set up in the 5th or 6th semester after the completion of garment structure courses and garment technology courses. Therefore, the "successive" relationship between garment structure courses, garment technology courses and garment CAD course is formed. In addition, garment CAD course is often regarded as an independent software teaching course, it generally held by young teachers separately. "Independent" relationship between garment structure courses, garment technology courses and garment CAD course forms. The teaching idea based on "successive independent " relationship leads to two main problems.

1.1 Repetition of teaching content

The structural examples in garment CAD course often come from garment structure course. From a certain point of view, it only adopts the digital way to repeat the professional knowledge teaching in garment structure courses and industry pattern making course. This "secondary drawing" causes a waste of students' time and energy.

1.2 Poor teaching effect

Garment CAD is a highly integrated course of theoretical and practical course. Only by taking garment structure course as the theoretical basis of design and garment CAD course as a new practical application means to realize fast and accurate structural design[4], can we achieve the effect of theory and practice integration. The fragmented software teaching artificially removes the theoretical basis of the course, resulting in the lack of "high-level" characteristic of the course. It is difficult for students to transfer their practical ability to other related courses, so the teaching effect is poor.

Therefore, the curriculum based on the "successive independent" relationship does not adapt to the educational concept of "Two Characteristics and One Challenge". In addition, the change of educational ecology and the upgrading of industry urgently demand teaching managers and front-line educators to change their thinking, and make corresponding improvement in teaching ability.

2. The feasibility of constructing the "identical fusion" relationship

The "identical fusion" relationship integrates software teaching of garment CAD into the garment structure courses and garment

technology courses respectively. The two integrated courses are undertaken by a teacher specializing in garment structure or a teacher specializing in garment technology respectively.

2.1 Theoretical basis of constructing the "identical fusion" relationship

The teaching emphasis of garment structure courses is to understand and apply the structure principle and change rules, while the difficulty lies in establishing the transformation thinking between two-dimensional structure pattern and three-dimensional garment. Therefore, in teaching process, two-dimensional garment CAD software is used to change the structural principle into structure diagram firstly, and then three-dimensional CAD software is used to turn the two-dimensional structure diagram into three-dimensional garment.

Garment technology courses focus on understanding the relationship between garment pieces and craft techniques practice, the difficulty lies in accurate recovery of the sample garment. In this process, the correctness of garment pattern and craft techniques should be guaranteed. Before cutting, the wearing effect is simulated by three-dimensional CAD software to check the correctness of pattern, and then the two-dimensional garment CAD software is used for seam allowance adding and marker making, together with outputting accurate pattern by supporting hardware equipment.

The teaching processes of two-dimensional and three-dimensional garment CAD are carried out by obtaining structure drawings, pattern, marker and clothing effect drawings, dynamic display respectively. Both processes cannot separated from garment structure and craft techniques.

It can be seen that garment structure, craft technique and garment CAD are mutually integrated and inseparable in theoretical foundation and teaching practice.

2.2 Advantages of constructing "identical fusion" relationship

Improve the teaching status of CAD. Generally, the series of garment structure course is divided into three parts: women's lower garment structural design, women's upper garment structural design, men's wear structural design / children's wear structural design; the series of garment technology course is accordingly divided into three parts: women's lower garment technology, women's upper garment technology, men's suit / children's garment technology. The teaching process of garment CAD is offered continuously in three semesters along with garment structure and garment technology courses. This kind of immersion teaching not only shows its importance, but also changes its subordinate position.

Stimulate students' learning interest. In garment structure courses, the structure diagram is no longer a complex combination of algebra and geometry, the garment technology courses are not limited in the craft room too. With the help of two-dimensional and three-dimensional garment CAD software, the garment structure diagrams can not only represent as static ready-to-wear, but also can make into dynamic show by changing their pattern and material of fabrics, the makeup and hairstyle of models and the background and music of stage so as to visualize the works of garment structure courses and garment technology courses.

Improve the teaching efficiency. The drawing function of garment CAD is learned and strengthened in series of garment structure courses. Adding seam allowance, marker making and outputting function of garment CAD are practiced in series of garment technology courses. These teaching requirements can only be achieved in the fifth or sixth semester under the "successive independent" relationship, while students can obtain them in advance under the "identical fusion" relationship mode. It lays a solid foundation for students to enter the role of professional competition and the subsequent graduation project.

Reduce the intensity of laboratory construction and maintenance. At present, personal computer has become one of necessities of contemporary college students, and the vast majority of colleges and universities have achieved campus network coverage. Under these circumstances, students only need to install the corresponding CAD software on their personal computers to study anytime and anywhere in the classroom, dormitory and home, which greatly reduce the dependence of learning process on professional laboratories.

Under the "identical fusion" relationship mode, it is a positive response to the current educational ecology and industry needs to update the teaching means. Meanwhile, it puts forward certain requirements for teachers' professional comprehensive ability. Both the concept of education administrators and the professional ability of front-line teachers need to improve in accordance with the changes of the times.

3. Selection of CAD software and course integration under "identical fusion" relationship

The individuation of garment products has become the focus of consumers' attention. Therefore, some garment enterprises have started the personalized customization business. In customization business, there are two technical schemes for pattern design: one is intensive size mode and the other is manual debugging mode[1]. However, neither of these two models can quickly meet the personalized customization of "one pattern for one consumer". Some scholars put forward the concept of "parametric pattern design" to realize the intelligent automatic generation for individual pattern though parameterization of garment structure[5]. Taking this as starting point, the general AutoCAD software for engineering specialty and CAD software for garment specialty are selected, and both of them are integrated into the course of garment structure and garment technology.

3.1 Application of AutoCAD software in garment specialty

Data accuracy and repeatability of structure diagrams. The word "roundness", a kind of experiential feeling, is often mentioned during garment CAD drawing, which is difficult for beginners to master. However, by general AutoCAD software drawing, the garment contour line can be described accurately in mathematical way though arcs and biarcs fitting[6]. On this basis, whether it is multiple structural diagrams drawn by the same person or the same structural diagrams drawn by different people, its repeatability in size can be guaranteed, which gets rid of the defect of empirical manual drawing.

The function of parameterized pattern design. The parametric design module of AutoCAD software establishes a corresponding

relationship between "user parameters" and "geometric constraint parameters". The linkage change of structure diagram can be realized by modifying the "user parameters", which greatly increase the drawing efficiency. Once the "grade" parameter is set, the dynamic changes among sizes can directly realizes at real time, then it completely abandon a series of cumbersome traditional work of grading.

Secondary development function adapting to professional requirements. AutoCAD software allows users to customize menus and tools column. The secondary development is allowed though the embedded languages, that is, AutoLISP, Visual Lisp, VBA, ADS, and ARX.

At present, students in fashion design and engineering specialty are non-art fresh graduates. For some students interested in computer aided design, they are provided with an expanded educational channel, that is, "from shallow to deep, from easy to difficult". It coheres with the "challenge" requirement in the current educational concept of "two characteristics & one extent".

3.2 Integration of general/professional CAD software with core professional courses

The series of garment structure courses are the basic module of the core professional courses. They are carried out structure design for women's, men's and children's ready-to-wear according to the GBT/1335.2-2008 continuously opening in three semesters. In order to meet with the personalized dress demand of consumers, the structure design ability for personalized customization garment according to individual body shape should be equipped. The parameterized pattern design function of AutoCAD software just meets the learning requirement, and the corresponding structure design for personalized customization garment course is the high-level module for series of structure courses. Therefore, the garment structure courses are well integrated with AutoCAD softwa re on the basis of learning continuity.

The series of garment technology courses are the practical module for the core professional courses. The technology of classical style for women's, men's and children's garment is trained continuously in three semesters, too. In garment technology courses, the perfect garment diagram is taken as start point, combined with the theoretical knowledge of seam allowance adding and marker making, the classical style for women's, men's and children's garment are obtained. In the process from structure diagram to pattern, CAD software is required, the AutoCAD software is not as convenient as garment professional CAD, therefore, the garment technology courses integrate with garment professional CAD better.

Although the structural diagram drawn by AutoCAD software can not be directly read by CLO3D software, through the transformation of professional garment CAD software (such as Richpeace CAD software), AutoCAD files in DXF format can be read in CLO3D software, and then the three-dimensional dress effect can be obtained through virtual stitching. Therefore, the general AutoCAD software and garment CAD software are not completely separated, they organically integrate according to different characteristics and teaching purposes.

4. Reform practice of garment CAD teaching

There are two teaching forms of garment structure courses and garment technology courses in colleges and universities: one is manual drawing, the other is drawing by CAD software. In order to make the reform targeted, teaching reform plans aiming at these two teaching forms are put forward.

4.1 Reform of garment CAD course based on "successive independent" relationship and manual drawing means

In current situation of "successive independent" relationship and manual drawing, as teaching administrators, in order to improve teaching efficiency and stimulate students' interest in learning, garment CAD course,which is usually set up in the fifth or sixth semester, can be advanced to the same semester as garment structure courses. The total class hours of garment CAD can even be distributed in three consecutive semesters, small period and many times. It can primely serve the courses of garment structure and garment technology.

One teacher adopts manual drawing method in teaching process of garment structure or garment technology, at the same time, another teacher draws structure diagram in CAD way. In this situation, It is easy for student to experience the differences between manual drawing and CAD drawing. Under the inspiration for convenience and efficiency of garment CAD drawing, student can get in touch with garment CAD software earlier. At present, there are many network learning platforms, it is convenient for student to self-study relevant CAD software in their spare time, which will promote learning effect for garment structure and garment technology in the next two semesters. On the other hand, it also encourages older teachers to continue learning and improving, which is in line with the principle of " to teach is to learn".

4.2 Curriculum group reform based on the "identical fusion" relationship

Under the "identical fusion" relationship mode, the concept of "garment CAD" course of fashion design and engineering speciality should includes at least three kind of software, that is AutoCAD, Richpeace garment CAD and CLO3D. They integrate into garment structure courses and garment technology courses. Therfore, the narrow concept of "garment CAD" course by ways of software teaching is broken down. It is imperative to construct a core professional curriculum group on the theoretical basis of garment strcture courses and the practical platform of garment technology courses, together with the integration of "two-dimensional to three-dimensional" concept.

Construction of curriculum group. Under the concept and practice of "identical fusion" relationship, the garment structure courses and garment technology courses are taken to consolidate the professional foundation, and the computer foundation and programming knowledge is taken as starting point. Two alternative professional development directions are provided for students with different interests and abilities: cultivating the practical ability to adapt to various professional competitions in the comprehensive practical of garment CAD course; strengthening the scientific research ability for graduation thesis and further education in the customized garment structure course.

In the teaching process of garment CAD comprehensive practice course, the standard body shape of men, women and children are taken as the object, 4-6 sets of creative clothes are designed, together with a complete set of structure diagrams, patterns, static dressing effect pictures and dynamic show videos. Guided by students' works, the works with good creativity are recommend to various professional competitions to accept the real test from market. Therefore, it not only provides materials for competitions, but also paves way for graduation design.

In customized garment structure course, the personalized type of human body is taken as object, such as sliding shoulder, hunchback, convex belly, O-leg and so on, the garment structure diagram that can be adjusted parametrically is obtained. Students master the interactive relationship between body shape characteristics and structural parameters, so as to provide thought for in-depth research on the direction of garment structure in bachelor thesis. This organic integration of knowledge ability and quality aims to cultivate students' comprehensive ability and advanced thinking to solve complex engineering problems, which is the concrete embodiment of the "high-level" of garment structure courses.

Teaching equipment requirements. Under the "identical fusion" relationship, certain requirements for teaching equipment are put forward, the software and hardware required in series of courses are shown in Table 1.

Table 1 Matching between course series and CAD software/hardware

Curriculum Name	software/hardware requirement
Garment technology series	Richpeace garment CAD、CLO3D(Fundation)、Richpeace garment CAD hardware output
Garment structure series	AutoCAD(Fundation)、CLO3D(fundation)
Garment CAD comprehensive practice customized garment structure	CLO3D(Fundation and Dynamic rendering)、AutoCAD(Parametric Function)、Richpeace garment CAD software/ hardware

The software of Richpeace garment CAD, AutoCAD and CLO3D required in study of garment structure courses and garment technology courses can be used on students' personal computer which greatly reduces the construction and maintenance cost of computer laboratory. During the process of garment virtual display and rendering, specific garment materials, model makeup, stage background and other materials can be easily purchased on CLO3D's official website. In terms of hardware, Richpeace high-speed printer in width of 1.8m used for teaching costs about 30000 RMB. In the teaching operation, the printer needs to replace the ink cartridge and paper. Take the teaching class of 30 students as an example, two ink cartridges and a roll of paper purchased collectively which cost 25RMB per capita can meet the teaching requirements. In this way, the problems of pattern room construction, teaching material management and health maintenance are effectively solved.

Under the background of the Internet era, computer aided design has already penetrated into all walks of life. It is an important objective for engineering talent training to solve complex problems with modern tools combined with the concept of Engineering Certification Education. A good curriculum system lays a solid foundation for talent training and professional development. The ideological guidance and ability improvement of teaching managers and front-line teachers provide a strong guarantee for the output of excellent talents. Technically, the CAD software for garment specialty is expanded from two-dimensional to three-dimensional, and the general cartographic software AutoCAD in engineering specialty is introduced. In teaching practice, the CAD software application is integrated into the garment structure courses and garment technology courses, so as to build a core professional curriculum group. It get through the last mile for the perfect match between talent training of garment engineering specialty and personalized customization market demand.

References:

[1] HE Xianting. Digital technology drives customized transformation of garment industry. Basic sciences journal of textile universities. 2018.03, Vol.31, No.1, 131-135.

[2] ZHANG Hua. Discussion on the course of garment CAD for pattern making. Pioneering with science & technology monthly. 2015. No. 19, 79-80.

[3] ZHANG Tao. Teaching reform and research of garment CAD course in univercity. DAGUAN (Forum).2019.05.194-195.

[4] LI Tong. Discussion on the integration of garment CAD and garment structure design course. Science & Technology information.2017(25): 145, 217.

[5] YANG Shoumin. Technology and application of intelligent garment pattern design. Information: technology and application. 2019.09. Vol.20, No. 9. 152-153.

[6] LOU Shaohong. Diagram of biarc and its application in design of garment seam outline. Journal of Textile Reseach. 2019.09. Vol.40, No. 9. 150-158.

Author's brief introduction: Ziwei Huang (1983-), female, Hubei XiaoGan province, lecturer, a master's degree. Research direction: garment structure, garment technology.