

# Transformation and Upgrading of Furniture Industry in Pearl River Delta Promoted by Industry-education Integration

-Taking Shunde Polytechnic as an Example

Long Gan, Rongfa Wang and Qilong Wen

Shunde Polytechnic,  
Shunde, Guangdong, 528300

**Abstract**—This paper studies what higher vocational colleges have done to promote industrial transformation and upgrading brought by industry-education integration when it comes to the major level, and mainly studies by promoting the improvement of talent cultivation and skills in school-enterprise by jointly building national-level vocational education and teaching resource library for furniture design and manufacturing major; The teaching mode of "project-oriented, and task carrier" is established by national-level professional teaching team that combines part-time and full-time teachers in the school and enterprises; Under the mode with combination of government-industry-school-enterprise and "competition-study integration", talents with innovative skills are cultivated, and industry service capacity is improved; The school has cooperated with enterprises to build up core courses and practical productive training basis for the digital manufacturing of furniture, core technical talents are cultivated for the transformation and upgrading of customized furniture industry, with integration of innovative teaching mode, the three-in-one graduation design of school-enterprise merged "graduation thesis defense, graduation exhibition, talent recruitment", is formed, and the integration mode of three-in-one industry-education of "talent-specialty-scientific research" is upgraded; The school has cooperated with enterprises to jointly formulate advanced standards for the industry, guide and normalize furniture industry; Results: Furniture design of Shunde Polytechnic has realized the transformation and upgrading of Pearl River Delta furniture industry by the aforementioned five "industry-study integration" routes. Innovation: In the industry-education integration process, the school has achieved win-win results in the cooperation with enterprises, as well as in its sustainable development.

**Keywords**—furniture design; industry-education integration; transformation and upgrading; teaching mode

## I. INTRODUCTION

As stipulated in the *Decisions of the State Council on Speeding up the Development of Modern Vocational Education*: Deepen industry-education integration, school-enterprise cooperation, and cultivate hundreds of millions of high-qualified workers and technical skill talents. Since 2016, the furniture design specialty in Shunde Polytechnic has promoted the national-level vocational education and teaching resource library for furniture design and manufacturing

Fund: Specialty construction project for higher vocational education brand in Guangdong Province (YJGH [2015] No. 191 Document); School-level professional leading talent cultivation objects in Shunde Polytechnic (SZYR Zi [2018] No. 98 Document).

specialty by regarding provincial first-class brand specialty and high-level specialty construction in provincial first-rated colleges as the opportunity, and has created national-level professional teaching team that combines part-time and full-time teachers. Besides, it has also adhered to the talent cultivation characteristics that combine design and manufacturing based on "One-platform and Two-center" and "Furniture Design Cooperated Cultivation Platform in Guangdong Province", "Furniture Engineering and Device Digital Technology Cooperated Innovation Development Center in Guangdong" and "Furniture Manufacturing Engineering Technical Development Center for colleges in Guangdong", innovated "talent-specialty-scientific research" three-in-one industry-education integration mode, integrated qualified resources in the school and enterprises. The school has cooperated with enterprises to jointly built core courses and practical productive training base for digital manufacturing of furniture, while the school has cooperated with the industry and enterprises in formulating advanced standards of the industry, and built furniture design specialty into the highland for furniture design talent cultivation in Pearl River Delta Region and even the whole world, promoted the transformation and upgrading of furniture industry, and further promoted international influence.

## II. PROMOTE THE IMPROVEMENT OF SCHOOL-ENTERPRISE TALENT CULTIVATION AND SKILLS BY JOINTLY BUILDING NATIONAL-LEVEL VOCATIONAL EDUCATION AND TEACHING RESOURCE LIBRARY FOR FURNITURE DESIGN AND MANUFACTURING SPECIALTY

The teaching resource library for furniture design and manufacturing specialty under vocational education was officially established by the Ministry of Education in July 2018, led by Shunde Polytechnic, and jointly hosted by Heilongjiang Forestry Vocational-Technical College, and Liaoning Vocational College of Ecological Engineering through cooperating with furniture specialty in 14 vocational colleges, undergraduate colleges and vocational schools nationwide as well as 28 furniture industry associations and furniture enterprises, including China National Furniture Association. The construction of vocational education teaching resource library is aimed to: 1. Build an international first-rated resource library that can provide teaching resources and teaching

services for students majoring in furniture design at school and social learners, provide technical support for the transformation and upgrading of furniture industry, with high-level vocational education characteristics, so that it can become the garden for students to study, the treasury vault for teachers to teach, the platform for government, schools, industries and enterprises to communicate and cooperation and the position for vast learners to study for a life time. 2. Establish sound resource library learning platform, including 15 professional core courses, 5 personalized courses and several key skill training modules as well as learning guidance, assistance system and other management platforms. The learning platform can be operated stably and reliably, and can bear 10,000 people online. 3. Establish portal websites with sound functions, including industrial information, professional resources, course resources, design resources, vocational training and social service. There are 17,169 currently registered users, 9,258 college users, and 7,911 enterprise and social learners. The professional teaching resource library can improve the teaching level of national furniture design specialty, improve professional knowledge and skills of furniture employers nationwide, and provide intelligent support for the transformation and upgrading of furniture industry.

### III. ESTABLISH NATIONAL-LEVEL PROFESSIONAL TEACHING TEAM THAT COMBINES PART-TIME AND FULL-TIME TEACHERS IN THE SCHOOL AND ENTERPRISES AS WELL AS "PROJECT-ORIENTED, AND TASK CARRIER" TEACHING MODE

The teaching team of furniture design specialty in Shunde Polytechnic established national-level teaching team in 2010. The teaching team is formed by professional teachers, and design directors of enterprises. It has combined design teachers and manufacturing teachers, adopted the teaching mode of "project-oriented, task carrier", input actual design projects of furniture enterprises to drive course teaching, and focused on carrying out project teaching as per the work mode of project group cooperation and the work flow of enterprise design<sup>[1]</sup>. Based on the project task assigned by the enterprise, the consumer demand and market conditions, closely combine design course teaching with the actual demand of the market and the enterprise. Project design will be carried out under the guidance of professional teachers and design directors of enterprises. School-enterprise cooperative training will run through the entire teaching process. Give play to professional advantages for different types of teachers, teach students theoretical knowledge and practical capacity, complete enterprise project design and manufacturing technology teaching, implement intergenerational transition between teachers and students, and convert design plans into products based on the practical training base inside and outside of the school. Under the work condition of actual project tasks, students can not only improve their design capacity, but also master the manufacturing techniques and skills, and realized "carriers in projects, process-valued in teaching, course planning, and achievement conversion".

### IV. MODE AND PRACTICE TO CULTIVATE TALENTS WITH INNOVATIVE SKILLS BY "COMPETITION-STUDY INTEGRATION", AND IMPROVE INDUSTRIAL SERVICE CAPACITY

"Competition-study integration" drives teaching by design competition projects. It regards all types of design competitions as the carrier for course teaching, integrates with teacher studio and students' workshop, promote teaching and learning by competition, refines the level of teaching contents and the innovation capacity by competition, lays a foundation for professional quality and design innovation capacity with the sense of competition, cultivates innovative furniture design talents. Both furniture design teachers and students have won a total of above 500 golden, silver and copper awards, and made it become the school with the most professional awards of furniture in China.

Competition-study integration" is adopted to hold high-level and influential furniture design competition. Based on the influence of the specialty in the industry, "government-school-industry-enterprise" cooperation is adopted to explore and practice competition-study integration mode by virtue of the industrial advantages of Shunde furniture. Furniture specialty in the school cooperated with Shunde Lecong Town Government to hold a total of four sessions of Lecong International Furniture Design Competitions from 2001 to 2004. The school cooperated with China National Furniture Association, Guangdong Provincial Furniture Association and Shunde Longjiang Town Government to hold a total of three sessions of "Dragon" Furniture Design Competition from 2011 to 2013 at the key furniture manufacturing town of China, Longjiang. The competition was carried out under the theme of "sofa", "E-business furniture" and other themes in Longjiang Town. 2016-2017 "D&B" Cup furniture design competition was sponsored by China National Furniture Association, and jointly undertaken by furniture design specialty in Shunde Polytechnic and Chengdu D&B Furniture Manufacturing Co., Ltd. in 2016, to provide intelligent support for the transformation and upgrading of furniture industry. The competition was planned and organized by furniture design teachers, and gained a big success. "Competition-study integration" promoted the close cooperation of "government, industry, schools, and enterprises", realized win-win results, and expanded the influence of furniture design specialty.

"Competition-study integration" implanted enterprise design project in course teaching by the mode of campus design competition. The furniture design specialty cooperated with Xinda Clover Industry Limited Company Nanhai Foshan City to hold two sessions of "Xinda Clover Cup" Campus Furniture Design Competition. Besides, it has also cooperated with Foshan Zhuoer Wenyi Co., Ltd. to hold two sessions of "Pinocchio" New Chinese-styled Campus Furniture Design Competition, and "Franklin" sanitary ware company to hold Bathroom Cabinet Campus Design Competition, and has solved design difficulties for enterprises, provided lots of valuable innovation design plans. Substantial achievements have been obtained in industry-education integration, and campus furniture design competition has comprehensively improved students' professional skills, and works selected by enterprises were deeply promoted to the market and obtained

essential market report, and campus design competition has acquired the soil to develop sustainably. The "competition-study integration" mode and practice of the furniture design specialty to cultivate talents with innovative skills won the First Prize of Teaching Achievement Award for Vocational Education of Chinese Light Industry in 2017.

V. INNOVATE "TALENT-SPECIALTY-SCIENTIFIC RESEARCH" THREE-IN-ONE INDUSTRY-EDUCATION INTEGRATION, AND INTEGRATE ADVANCED RESOURCES IN THE SCHOOL AND ENTERPRISES

The furniture design specialty cooperated with Homekoo and other companies to jointly declare for "the Technical Development Center for Furniture Manufacturing Engineering in Guangdong Colleges" and obtained the official approval of the Department of Education of Guangdong Province in 2013. Besides, it also declared for "Collaborative Innovation Center for Furniture Manufacturing Engineering and Device Digital Technology in Guangdong" and obtained the approval of the Department of Education of Guangdong Province in 2014 by cooperating with National Engineering Research Centre of Near-net shape Forming for Metallic Materials, South China University of Technology, Guangzhou Landbond Group Co., Ltd., Weili Mechanical Industry Co., Ltd., Helisheng (Guangzhou) Honeycomb Product Co., Ltd., HOMAG China Golden Field Limited and other four famous enterprises of furniture industry in Guangdong as well as other R&D institutions. Based on these two scientific research platforms, on one hand, it has realized the in-depth integration with industrial enterprises, jointly promoted the technical progress of the furniture industry, and led the traditional furniture manufacturing industry to transform and upgrade towards digital, informatization, standardization and low carbon; On the other hand, it has improved the external service capacity and teachers' professional level related to furniture design, and realized win-win results in school-enterprise cooperation.

Over 3 years, the furniture design specialty has completed about 10 school-enterprise horizontal topics, above RMB 1 million horizontal task incomes, obtained 1 invention patent authorization, 12 practical and new patents, and a total of

above 150 appearance patents; It has accumulatively trained above 500 enterprise backbones, carried out skill training for above 5,000 people, and the cooperation enterprises can take leading position in the industry, such as, OPPEIN Group, Sophia Group, Homekoo Group, Landbond Group, HOMAG, Nanxing Device Group, etc. The school has realized resource sharing of school, industry and enterprises. By cooperating with international leading supplier of the furniture industry, it has established sustainable cooperation relations with Austria Blum Hardware Company, German HOMAG Wood-working Machine and Software Company, German Hettich Hardware Company, German REHAU Edging Material Company, German Schattdecor Decoration Material Company, etc. The school has carried out in-depth cooperation with enterprises in teaching, scientific research and employment, and the furniture design specialty has solved the common problem of informatization and product quality in customized furniture for customized furniture industry. Hettich donated RMB 600,000 teaching equipment and resources for furniture design specialty, and provided big support for the teaching of digital manufacturing of furniture technologies, furniture materials and the construction of teaching resource library related to furniture design.

VI. THE SCHOOL HAS COOPERATED WITH ENTERPRISES TO JOINTLY FORMULATE ADVANCED STANDARDS OF THE INDUSTRY, GUIDE AND NORMALIZE THE DEVELOPMENT OF FURNITURE INDUSTRY

The furniture design specialty has cooperated with Guangdong Testing Institute of Product Quality Supervision Shunde Branch, Foshan Shunde Furniture Research Development Institute, Guangdong Landbond Furniture Group Co., Ltd., Nanxing Machinery Co., Ltd., etc., to be engaged in formulating industrial standards, and has accumulatively led the formulation of 1 national standard, 4 industrial standards, participated in formulating 14 industrial standards, 5 team standards, and 1 alliance standard, and filled up the blank in the technical standard of furniture industry, and exerted important social significance to guide and normalize the development of the entire industry.

TABLE I PARTIAL NATIONAL INDUSTRIAL STANDARDS LED AND FORMULATED BY THE FURNITURE DESIGN SPECIALTY OVER THE YEARS

Standard formulation	Take the lead in formulating 1 national standard, 4 industrial standards, and participate in formulating 15 industrial standards	<ol style="list-style-type: none"> <li>1. Take the lead in formulating GB/T 32445-2015 <i>Classification of Furniture Material</i></li> <li>2. Take the lead in formulating QB/T 4369-2012 <i>Honeycomb Paper Core for Furniture (Panel)</i></li> <li>3. Take the lead in formulating QB/T 4374-2012 <i>Furniture Manufacturing and Wood Panel Operation and Technologies</i></li> <li>4. Take the lead in formulating QB/T 4464-2013 <i>Technical Requirements for Honeycomb Panel Parts of Furniture</i></li> <li>5. Take the lead in formulating QB/T 4465-2013 <i>General Technical Requirements for Furniture Packaging</i></li> <li>6. Participate in formulating QB/T 4370-2012 <i>Soft and Flame-retardant PU Foamed Plastics for Furniture</i></li> <li>7. Participate in formulating QB/T 4371-2012 <i>Mold Resistance Evaluation for Furniture</i></li> <li>8. Participate in formulating QB/T 2189-2013 <i>Furniture Hardware cup-shaped Blind Hinge</i></li> <li>9. Participate in formulating QB/T 2454-2013 <i>Furniture Hardware Drawer Guide Rail</i></li> <li>10. Participate in formulating QB/T 4466-2013 <i>Technical Requirements for Bed Surface</i></li> <li>11. Participate in formulating panel saw series of standards for numerical control woodworking (submitted for review)</li> <li>12. Participate in formulating five-axis and polyhedral-drill series of standard for numerical control woodworking (submitted for review)</li> <li>13. Participate in formulating a series of standard for woodworking combined machining center (submitted for review)</li> </ol>
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VII. THE SCHOOL HAS COOPERATED WITH ENTERPRISES IN BUILDING CORE COURSES AND PRACTICAL PRODUCTIVE TRAINING BASE FOR THE DIGITAL MANUFACTURING OF FURNITURE, AND CULTIVATING CORE TECHNICAL TALENTS FOR THE TRANSFORMATION AND UPGRADING OF CUSTOMIZED FURNITURE INDUSTRY

In order to cope with the increased demands of customized furniture enterprises for composite talents of digital manufacturing of furniture incurred by changes in vocational standards during the reform of furniture manufacturing industry from traditional design, production and sales mode to digital design, production and sales mode, the furniture design specialty has included the core course of Digital Manufacturing of Furniture into talent cultivation plan<sup>[2]</sup>. Above RMB 10 million were input in 2016 to build the practical training base for digital manufacturing of furniture by cooperating with HOMAG, and the practical training base includes international leading practical training equipment and software, and has effectively solved the practical teaching bottleneck in the compound talent cultivation for digital manufacturing of furniture, largely improved students' professional level and practical capacity and reinforced the professional external service and training capacity. By the courses and practical productive training base jointly built by the school and enterprises, students can fast master the world's most advanced customized technologies from software to hardware, and concepts to practical operation. Besides, this has also met the urgent demand of fast developed customized furniture enterprises for talents. The furniture design specialty has

attracted high attention from industrial enterprises, and graduates have been fully employed by famous customized furniture enterprises, and the employment quality was largely improved. The employed quantity of graduates majoring in furniture design was increased year by year in OPPEIN Group, Sophia, Holike, Fuanna, and other listed companies, so we can see the recognition degree of industrial enterprises for graduates majoring in furniture design.

VIII. INNOVATE THE TEACHING MODE OF "THREE-IN-ONE" GRADUATION DESIGN, AND IMPROVE TALENT CULTIVATION QUALITY

Being led by furniture design specialty, the School of Design has established the overall innovative teaching mode of "graduation thesis, graduation exhibition, and talent recruitment" three-in-one graduation design<sup>[3]</sup> oriented to innovation capacity based on employment quality, and has realized the market evaluation of talent cultivation quality, effectively improved talent cultivation quality and expanded the social influence of the specialty. Adhere to carrying out graduation design by regarding the actual project of enterprises as the carrier. The school has cooperated with enterprises in guiding students' graduation design, and completing the product conversion of design plans. And organize annual graduation design work exhibition and talent promotion conference. Invite the industry and enterprises to participate in exhibitions for recruitment. Enterprises can watch students' works at site, listen to the students' thesis defense, and select talents as per their demands. Students' employment quality has been effectively improved by the teaching mode of "thesis



defense, exhibition and promotion" three-in-one graduation design exhibition and talent promotion conference with the participation of the industry, enterprises and the specialty. Above 200 graduates majoring in furniture design will graduate per year, and the employment rate is close to 100%. The salary starting point was increased year by year along with the increased ratio of entrepreneurship for graduates as well as the constantly improved attention and satisfaction of employers for graduates. "Cultivating for a decade in full blossom--overall innovation for the teaching mode of higher vocational art design and graduation design" won the second award of teaching achievements by the Ministry of Education.

#### IX. CONCLUSION

The furniture design specialty in Shunde Polytechnic is engaged in promoting school-enterprise talent cultivation and skill promotion by building national-level vocational education and teaching resource library for furniture design and manufacturing specialty Reinforce the construction of teacher team, combine school-enterprise part-time and full-time teachers, and transform traditional teaching mode by "project carrier, task-driven" thoughts under school-enterprise cooperation; Establish the mode and practice to cultivate talents with innovative skills by "competition-study integration", and improve industrial service capacity Innovate "talent-specialty-scientific research" three-in-one industry-education integration, and integrate advanced resources in the school and enterprises; Improve scientific research service level, implement school-enterprise cooperation, to formulated advanced standard of the industry, guide and normalize the development of furniture industry; As for the teaching conditions, the school has cooperated with enterprises in building core courses and practical productive bases for digital manufacturing of furniture, cultivated core technical talents for the transformation and upgrading of customized furniture industry, established the teaching mode of "three-in-one" graduation design, implemented industry-education integration, promoted talent cultivation quality and promoted professional students for enterprises. Furniture design specialty in Shunde Polytechnic has been engaged in the constant innovation and practice of industry-education integration. The school has realized win-win results in cooperation, and sustainable development with enterprises. In above 20 years, it has provided talent and technical support for enterprises of the furniture industry sustainably, and assisted in promoting the transformation and upgrading of furniture industry in Pearl River Delta.

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