

Exploration of Training Mode for International Collaborative and Innovative Talents of Vehicle Majors Based on PACE Program

Wei Xiaoxu^{1,2,a}, Liu Zhien^{1,2,b,*}, Xiong Xin^{1,2,c}, and Lu Chihua^{1,2,d}

¹ Hubei Key Laboratory of Advanced Technology for Automotive Components, Wuhan University of Technology, Luoshi Rode, Wuhan, China

² Hubei Collaborative Innovation Center for Automotive Components Technology, Wuhan, China
a. wxx2014@whut.edu.cn, b. lzen@whut.edu.cn, c. aime_bx@163.com, d. chlu@whut.edu.cn
*corresponding author

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Abstract: As the economy and society enter a higher level of development, the automotive industry will be in gigantic need for the professional and qualified engineers, who can meet the strategic globalization needs of automotive companies. Based on the requirements of automotive professionals with the ability to cope with globalized working environment, a project-driven international collaborative education mechanism, an engineering innovation training mechanism for science and technology competitions, and outstanding education support mechanism to improve comprehensive ability are proposed and researched on PACE platform. The outstanding education training mode which consists of three mechanisms of international collaborative engineering innovation and outstanding personnel training pattern, can fully mobilize students' enthusiasm for learning and boost their curiosity in engineering education. Additionally, the pattern also plays an important role in enhancing students' international ability, improving students' engineering practice innovation ability, so that the engineering students can better deal with the challenges in the automotive industry.

1. Introduction

With the continuous innovation of science and technology, the automobile industry will face some new challenges and revolutions. The international expansion of automobile companies will further broaden the global vision of the enterprises, and the automotive engineers will perceive the urgency of globalizing to meet the strategic needs in automobile enterprises. Accordingly, there will be an intellectual shortage of qualified engineers in the automotive industry. Cultivation of collaborative and innovative talents from an international level is the base stone of development in Chinese automobile industry, and it is also a new requirement for the development of higher education system in innovative engineering practice[1].

The PACE program (Partners for the Advancement of Collaborative Engineering Education), or "Computer Collaborative Engineering Advanced Technology Education Partnership Program", is a joint effort of more than 20 world-renowned companies including General Motors, Autodesk, HP, Siemens, and Oracle. Established in 1999, PACE program aims to provide college students with a virtual work and learning environment similar in the automotive or supplier enterprises through technical knowledge, financial support and relevant computer software and hardware to develop their international collaboration and innovative abilities. For the purpose, students follow the procedures of research and product development in famous automobile companies, and explore new types of talent training patterns based on future mobile vehicle product development projects.

Based on the PACE program, an education training mode has been established focus on students' international education, innovative ability and comprehensive ability[2, 3]. The three mechanisms are project-driven international collaborative education mechanism, engineering innovation training mechanism for science and technology competitions, and excellent education support mechanism to enhance comprehensive ability of international collaborative and innovative engineers. The education training mode is shown in Figure 1.



Figure 1: The education training mode are composed of 3 mechanisms.

2. Project-Driven International Collaborative Education Mechanism

The PACE program provides many types of competition projects: a practical project to develop the specific abilities; 1-year Collaborative and Innovation Challenge (CIC) project; 2-year international universities collaborative challenge project. During the implementation of the project, a project-driven international collaborative education mechanism is put into practice[2].

2.1. Project Training Based on the Actual Car R & D Process

Car company provides the process of actual automotive product development. Students can therefore follow this process to complete the competition project, including market research, concept design, modeling design, structural design, performance development and performance simulation, electrical control system development and electrical control. Design and analysis of unit simulation, virtual equipment and manufacturing technology, product recycling and utilization are also part of the training. Through the project training consistent with the actual product development process of the enterprise, students are expected to establish design concepts for the

entire life cycle of automobiles, consciously master a variety of engineering analysis software, practice the theoretical knowledge from classes and improve the lifelong learning ability.

2.2. Cooperation and Exchange among College Students at Home and Abroad

The core concept of the PACE program is to cooperate. Effective cooperation is based on mutual communication and collaboration. The three types of international competition projects implemented by PACE encourage students from different countries, different schools, different project teams, and project team members to exchange and cooperate with each other. They undertake different design, analysis, and manufacturing tasks, and determine every milestone in the project. The regular phone meeting of project is prepared. Members of the team are prepared before the meeting, and they communicate effectively at the meeting with the help of Internet video conferencing and implemented basic ideas in the project after the meeting, which is an international collaborative working method of students across time zones, countries and races.

2.3. Joint Training of International and Domestic Enterprises and Universities

PACE partner companies provide multiple trainings for students from PACE universities every year, including engineering software applications, product development processes and specifications, and professional knowledge training. GM engineers in the United States will formulate a novel and challenging theme for the project competition based on the trend in automobile industry, which normally also meets the interests of the students. The PACE Center headquarters in the United States regularly holds global PACE university project exchange meetings to check project progress and provide some guidance to the project.

2.4. Participate in International Competitions to Track Advanced Foreign Education

Each year, teachers from worldwide universities will participate in the PACE Global Conference, to exchange experience in talent training in the automotive engineering field and learn some brilliant education methods and concepts and track the latest results of foreign engineering education talent training. By sending students to participate in PACE annual conference reports and project competitions each year, students can thus practice their English and make industrial contacts with each other, and their horizons and mind-sets are therefore revolutionized and broadened, which can have a further influence both in PACE center and in their careers.

3. Engineering Innovation Training Mechanism for Science and Technology Competitions

Relying on the competition projects implemented by PACE, students are encouraged to participate in various types of university student science and technology competitions in the country, which forms an engineering innovation training mechanism for science and technology competitions[4].

3.1. Selection and Grouping of Competition Teams Guided by Interest Goals

PACE Center enrolls undergraduates from the School of Automotive Engineering, the School of Automation, the School of International Education, the School of Mechanical and Electrical Engineering, the School of Mobility, and also the School of Art. From different backgrounds, students of different grades may find a common interest with selection criteria and grouping methods for main objectives. Each competition team is divided into the design group, the analysis

group, the manufacturing group and the electronic group according to the students' individual professional interests and hobbies, in order to maximize their personal strengths.

3.2. Knowledge Training for Independent Learning and Experience Sharing

In order to improve the engineering collaboration and innovation ability of students, a mixed competition team with various practical project experiences is gradually formed, which is guided and supervised by senior members. The main force of the middle grade is engaged in participating in specific competition projects, and freshmen of the lower grade are participating in reserve knowledge. During the project, the teacher will oversee the project meetings regularly to check the progress of the project. Each project team leader will inform project members on a weekly meeting to discuss project issues and offer some tips to new team members. When needed, graduate students, doctoral students, and even professors on campus will be invited to do special training to enhance students' professional knowledge.

3.3. Participate in Various College Competitions

Relying on the excellent student training mechanism of the PACE platform, students from self-organize teams will participate in various domestic competitions, including national college students' energy-saving emission reduction technology competitions, innovation and entrepreneurship training programs, "Internet +" university student innovation and entrepreneurship competitions, and school independent innovation Project, etc. In the participation of multiple competitions, the students' engineering innovation ability was improved.

4. Outstanding Education Support Mechanism to Improve Comprehensive Ability

Based on the opportunities provided by PACE center for cooperation and exchange with international universities, teachers from international and domestic universities have conducted joint practical activity, which has promoted engineering education for college students from curriculum education to independent engineering training, and has formed an excellent educational support mechanism to enhance comprehensive capabilities of engineer students[5].

4.1. Supplement and Improve the Curriculum System to Enhance Practical Ability

Actively adding the training content provided by companies to the existing curriculum system of universities and adding engineering application cases of professional theoretical knowledge to enrich the teaching content, to enhance practical ability of students, and supplements and improves the relevant knowledge system. It is necessary to pass relevant resources and knowledge to the entire school teachers and students, to enlarge the range of the audience through the provision of personalized courses "Electric Vehicle Virtual Development Technology" and "Automotive Product Cycle Virtual Development Technology". At the same time, based on the good communication and collaboration between PACE universities, teachers from different countries and universities should organize the practical activities, which greatly supplement and enrich the students' knowledge system.

4.2. Open Source Engineering Software Training and Support

International and domestic companies participating in the PACE program have donated a large amount of engineering application software to PACE universities, including commonly used

software such as NX, Autodesk, Matlab, and very professional engineering software. Through the server equipment, teachers and students can use the software for academic purposes, and acquire related engineering software training, which promotes the development of teaching and research projects to enhance comprehensive ability.

4.3. School-Enterprise Collaborative Engineering Practical Ability Training

The PACE Center recommends a certain number of PACE students each year to car companies for 3-6 months of internships. Through internships, advanced project management methods and product development processes are brought back to the universities, which will significantly supplement engineering knowledge of all PACE Center students. By organizing college teachers and students to visit R & D center, test center, and production plants, students can have a better understanding of the company's actual research and development process, testing process, and production and assembly process. The company also provides physical prototypes to support the design and innovation of college students.

5. Conclusions

With the economic society entering a higher level of development, the automobile industry will face a new development trend, and it will become an urgent problem for colleges and universities to cultivate international automobile talents to meet the needs of globalization. Conducting in-depth research on effective measures to improve students' international awareness and innovative thinking ability, supporting the national "The Belt and Road Initiative" of going global for the major demand for international talents, relying on collaborative projects and international competitions provided by international organizations as a carrier to supplement. A practical teaching system with personalized characteristics, establish international high-level teaching teams, explore a training model for international collaborative innovation talents in automotive engineering majors, mobilize students' enthusiasm for learning, enhance students' internationalization capabilities, and cultivate International professional talents.

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