

## A Study into Continuing Education of Automobile Industry Practitioners

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### ABSTRACT

With the rapid development of automobile technology, the transformation of automobile technology requires employees in automobile industry to enhance knowledge and competence through continuing education. As the automobile industry covers a large area, the continuing education of automobile industry employees has the following three characteristics: ①The staff's professional knowledge and professional competence are significantly different.②Their learning time cannot be fixed and the contradiction between working and learning is rather serious.③Employees should be required to have higher hand-on capability. Based on this characteristics, this study propose the staff in the automobile industry should be grouped according their professional knowledge and professional competence, and one group one training scheme. The combination of professional knowledge and practical ability should be emphasized during the training. The emphasis is put on two aspects:①Course modules are categorized by industry area;②Theses come from the practice. Three kinds of combination is emphasized as follows druring the training:①Combination of E-learning and face-to-face teaching.Through big data analysis on distance education system, find the key and difficult point in E-learning, and Teacher can focus on the point by face-to-face teaching. Furthermore mobile learning is very popular;②Combination of college teachers and business teachers;③Combination of internship training and virtual practice, advocate VR, AR technology in internship training session. After the training is completed, a training effectiveness assessment questionnaire is conducted to evaluate the contents of the curriculum, such as curriculum content, teaching manners and methods, and gains. Based on the assessment results, the content is continuously adjusted to enhance the training effect. Training model based on three kind of combination is valid to update student's knowledge and enhance their ability. It is a try to develop the future continuing education module.

### Keywords

Continuing education, Automobile industry, Combination, E-learning, Virtual practice

### INTRODUCTION

With the continuous development of automobile technologies, such as the improvement of automobile electronics technologies, the development of supercharger systems, and the emergence of new energy vehicles, practitioners of automobile industry need to improve their professional knowledge and skills constantly in order to adapt to technological changes in the

industry, therefore, continuing education is an efficient path to achieve this goal.

### 1. Demand Analysis of Training Needs of Auto Industry Practitioners

By the end of 2016, the sales of automobile in China have ranked number one in the world for eight consecutive years, and car ownership has been reached to a total of 190 million. The auto related industries, include auto design, production, marketing, maintenance, automobile finance, insurance service, second-hand car valuation, automobile leasing, and auto modification, are booming. Currently, there are more than three million practitioners working in these fields. The continuing education of automobile industry practitioners has the following three distinguishing characteristics:

1) The automobile industry covers a wide range of areas with diverse employee's educational background and knowledge background. Therefore, the demands for learning are vary, and difficult to conduct training sessions in a single mode.

2) Many practitioners in the automobile industry work in the front lines in the production workshops, repair shops, and 4S shops, their time of study cannot be fixed, and the contradiction between work and education is rather serious.

3) The characteristics of the automobile industry require that employees to have higher practical skills.

Therefore, these characteristics mentioned above should be fully taken into consideration in the continuing education for automobile industry practitioners. During the practice, we have been training them within different groups, and been providing targeted training courses for each group. Based on modern Internet technology and advanced education methodology, we have emphasized the combination of online and face-to-face instruction, and have invited teachers from both academic and business communities. Trainees have the opportunities to have experience in virtual experiment platform and to have hand on experience in real world. Therefore, Trainees could combine theories with hand-on practice in real world. We also emphasize on trainees feedback on the training courses, and continuous improve the qualities of our courses. Years of training has proved that this method can meet the needs of the people in the automobile industry, and improve the learning outcomes of the students.

### 2. Class Module Design for Automobile Industry Practitioners

According to the job functions of trainees in the automobile industry, we have analyzed the demands of continuing education in these areas. By considering professional knowledge and demands, we have set up class module into different categories. , Currently, We have five module categories, which are Automobile Design, Automobile Marketing, Automobiles Insurance and Claims, Assessment and Appraisal of Second-hand Cars, Testing and Repairing Techniques of Automobile etc., as shown in Table 1, to meet the demand of different automobile industry practitioners.

Table 1. The Main Module Courses

Module Category	Main Courses	Module Category	Main Courses
Automobile Design	Dynamics and Design of Automobile (1、2)	Automobile	Automobile Marketing

	Automobile Structure and Design	Marketing	Automobile Culture
	Principle of Internal Combustion Engine (1、2)		Social Etiquette
	Electronic Technology of Automobile		Automobile Engineering Services
Assessment and Appraisal of Second-hand Cars	Assessing and Testing Technique of Vehicles	Automobiles Insurance and Claims	Insurance
	Assessing of Second-hand Cars		Vehicle Maintenance and Inspection
	Asset evaluation		Automobiles Insurance and Claims
	Practical Technique for Assessing of Second-hand Cars		Managerial Communication
Testing and Repairing Technique of Automobile	Detection Technology of Automobile		
	Principle and Maintenance of Engine Electronic Control System		
	Principle and Maintenance of Automatic Transmission System		
	Practice of Motor Vehicle Maintenance and Inspection		

All of the above courses are made available online for students to study. These online courseware have distinct professional features. In the process of production, a large number of teaching tools are used to illustrate the teaching materials and practical cases, and the production of courseware is made by recording real scenes (automobile production, car maintenance, etc.). It is like that students are personally in the scene when they are watching the video courseware, which improves students' learning outcomes.

### 3. Better Instructors, Higher Quality Courses

A collaborative teaching team of university lecturers, business experts, and governmental officials should be built up. High-quality course contents need to be provided to students by taking advantages of the rich experience of each part. Course contents should include interpretation to the Macro Policy, industry trend, the technological frontier, and case studies. It is encouraged that instructors should fully interact with students in class. Multiple learning

methods like scene learning, experiential learning, discovery learning, learning through problem-solving should be applied comprehensively. Based on the principles discussed above, each instructor should be selected carefully using a three-step idea.

- 1) Three instructors in the relevant fields at least should be selected for each course.
- 2) An understanding into the instructors should be deepened through communication about course contents with them via emails, telephone, and interviews.
- 3) The most qualified and suitable instructor will be chosen according to the teaching plan and syllabus he or she has put forward so that teaching quality could be guaranteed.

At present, there is a teaching team of more than 600 instructors from the automobile industry, within which there are more than 300 university lecturers, 200 plus business experts, and about 50 governmental officials from various levels. This has met the basic requirements of continuing education from automobile practitioners.

#### 4. Focus on the Combination of Online Learning and Face-to-Face Instructions to Meet Learning Demands of automobile Practitioners

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##### (1) Encourage online learning through high-quality resources of teaching materials

Online learning (also known as E-learning) is a teaching and learning method used in a virtual internet classroom established based on the Internet or cellular network. The advantage of online learning is obvious: the problem of automobile practitioners not being able to find fixed time and location to study can be solved, and they can learn whenever and wherever possible. However, without neither a teacher present, nor a traditional learning environment, it is likely that students might get bored or tired. Online education and high-quality study materials are crucial to improving learning outcomes through online education. High-quality online courseware, which is presented with plentiful multimedia technologies such as Flash, three-dimensional animation and virtual simulation, can make it a movie-watching experience and prevent learning from getting boring or tedious.

With the development of cellular technology, there are no technical obstacles in mobile learning. Through the fragmented learning in spare time, students can balance work and study time. There has been an increase in the percentage of online education students using mobile phones. At present, all online courses of our university have been adjusted for mobile learning. There has been a progressive increase in the percentage of students learning through mobile phones every year. Diagram 1 shows the proportions of mobile learning students in total online students in recent years.

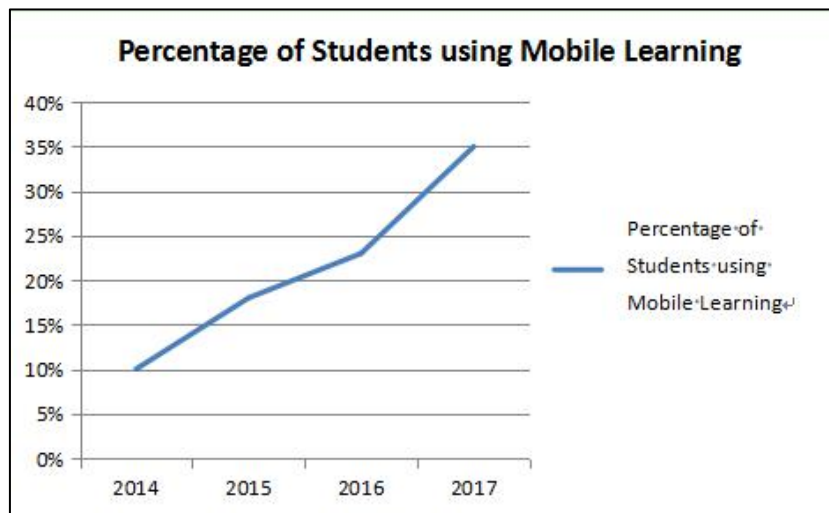


Diagram 1. Percentage of students in our university using mobile learning

## (2) Provide high-quality face-to-face teaching guided by online education big data

In hybrid learning theory, it is emphasized that both students' dominant roles and instructors' leading functions should be made prominent. In face-to-face teaching sections, in particular, teachers' leading functions are fully reflected. For example, focusing on challenging questions to explain can help students improve learning efficiency, and knowing students' hot topics can help enhance learning outcomes. Using technologies of the modern internet and big data mining, instructors' face-to-face teaching can be more focused.

## 5. Combine virtual simulation experiment with practical training, to improve students' practical abilities

There are more internship and practical training, and more practical requirements in automobile related courses. Due to the characteristics of adult education, it's impossible to let students have long-term internship in enterprises. As for internship and practical training, currently more popular way of teaching is to implement through creating virtual simulation laboratory, to compensate for the lack of internship and practical training. Through creating automobile virtual simulation experiment platform, setting up traditional practice bases, and combining virtual operation and actual training, with complementary advantages, School of Continuing Education of Beijing Institute of Technology cultivated the students' practical abilities.

### (1) Build automobile virtual experiment platform, to facilitate students to conduct various experiments simulating automobile maintenance and repair

After years of efforts, Beijing Institute of Technology utilized technologies including three-dimensional imaging, 3D MAX, EON to develop automobile virtual simulation experiment platform, which has included most of the experiments of automobile related courses, including basic teaching, simulation teaching, dismounting teaching, virtual teaching and automobile practical training, etc. The platform could simulate actual automobile maintenance and repair process, including 1733 basic teaching virtual experiments, 2846 simulation teaching virtual experiments, four virtual dismounting teaching experiments, and One VR simulation virtual troubleshooting experiment.

In the virtual experiment platform, 3D animation, video and virtual simulation teaching are utilized, students can rotate to view the entire automobile and parts from multiple angles, simulate dismounting and assembly of the entire automobile and each component module, to improve the efficiency of students' learning and training effect. Based on virtual reality, multimedia, interactive, database, and network communication technologies, the construction of high simulation of network virtual laboratory could achieve the function of automobile maintenance and repairs in the real environment practice, to make up for the deficiency of the continuing education practice.

From the current situation, virtual laboratory is of actual significance in improving teaching quality, meeting personalized learning requirements of different types of students, solving hardware investment insufficiency, and saving teaching cost, and is of especially great significance in cultivating the practical abilities of students, and improving the abilities of problem analysis and problem solving.

**(2) Rely on the training bases of on-campus and off-campus internship, to improve students' practical abilities**

In order to strengthen the practical training of students, we fully rely on the existing scientific research and teaching laboratories of mechanical discipline and the major of automobile engineering on campus, to build the adult education base of the university's major in automobile technology. In 2016, the School of Continuing Education and the School of Mechanical and Automobile jointly applied national professional and technical personnel continuing education base (new energy vehicles), which was approved by the Ministry of Human Resources and Social Security, with three million Yuan of construction funds. In 2018, Beijing Public Transportation Group and our university are planning to build electrocar laboratory, which would realistically exhibit the disassembling process of electric vehicles to the students by using VR, AR technologies, to promote the cultivation of practical abilities.

Off campus, the School of Continuing Education has cooperated with Beijing Changping Vocational School, Beijing Yizhongyi Educational Equipment Co., Ltd., Beijing Hyundai Motor Co., Ltd., Beijing Automobile Industry Senior Technician Training School, Mercedes Tianzhu Star Automobile Service Co., Ltd., Beijing Yazhijie Benz Car Sales Center, Beijing Quanta Automobile Maintenance Equipment Co., Ltd., Wantong Automobile School, and established more than ten off-campus practice bases. After mastering the relevant steps such as car dismantling and maintenance on automobile virtual simulation platform, the students would then go to the practice bases for further improvement, so as to have the effect of half the effort.

**6.Emphasize the combination of theoretical knowledge and practical work, to enhance the practical training effect**

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Main aim of continuing education of auto industry practitioners is to improve post capacity, course contents should be fully considered the needs of learners, closely combine knowledge learning and learners' post capacity together, to achieve the purpose of continuing education.

For example, the courses of a senior automobile training class in our school include several special lectures, such as automobile diagnostic tools and the utilization, ideas of failure analysis, and diagnostic methods; Detection method of high pressure common-rail fuel injection system and common fault diagnosis analysis; Development trend of hybrid electric vehicle, dynamic matching, structure principle and common fault diagnosis; Development



trend of LNG engine and fuel system, working principle troubleshooting; Development trend of Li-Poly, blade electric vehicle, dynamic matching, structure principle and common fault diagnosis; Clean energy automobile environmental performance, emissions standards, testing methods and WHTC test content. The content of each subject is closely integrated with automobile maintenance and repair, through a series of subjects learning, students can well apply knowledge to work in practice, and improve their post capacities.

#### **7. Pay attention to feedback of learning outcomes and keep improving course content**

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We would evaluate learning effects of students from multiple aspects including curriculum design, teaching modes and methods, and learning achievements at the end of each course, to better understand the learning effect. According to the evaluation results, we will constantly complete course content, and enhance learning effects.

#### **CONCLUSIONS & RECOMMENDATIONS**

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Three kind of combination is proposed during the training in this study, such as combination of E-learning and face-to-face teaching, combination of college teachers and business teachers, and combination of internship training and virtual practice. Training model based on three kind of combination is valid to update student's knowledge and enhance their ability .

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