

Thoughts and Measures for Carrying Out Innovation and Entrepreneurship Education in Automobile Inspection and Maintenance Technology

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Abstract: In recent years, China's automotive inspection and maintenance technology has developed rapidly. On the basis of learning from innovation and entrepreneurship, a series of researches and discussions on the professional education of automobile inspection and maintenance technology have been carried out, and remarkable achievements have been made. However, we all face a serious problem together, that is, with the continuous expansion of the enrollment of automotive inspection and maintenance technology and the development of technology in this specialty, the method of training personnel in automotive inspection and maintenance technology should become a key issue. Therefore, this paper analyzes the shortcomings of current modern vehicle inspection and maintenance technology and feasible coping strategies, including equipment, technology, testing methods, and talents. It is hoped that through analysis and clarification of current conditions and improvement of relevant theories, it will provide some reference for the development of follow-up work.

1. Introduction

With the continuous improvement of people's living standards, the sustained and healthy growth of the social economy, the improvement of people's living standards, the number of cars is gradually increasing. Increasing use of cars and opportunities, car failures and problems, and the need for comprehensive testing and maintenance are also increasing. Therefore, it is necessary to cultivate a large number of high-quality talents and participate in the inspection and maintenance of automobiles. Colleges and universities have generally established automotive testing and maintenance technology, teaching students professional car testing and maintenance knowledge, and improving students' practical skills. At this stage, in the process of carrying out teaching work, colleges and universities need to actively adopt effective teaching methods to enhance the overall

teaching results. In order to achieve this goal, it is necessary to apply the corresponding vehicle detection and maintenance technology, and at the same time actively adapt to the technological development requirements of the current era, and constantly apply new technical means to promote the sound and stable development of China's automobile industry.

2. Insufficient Technology of Modern Automobile Inspection and Maintenance

2.1. Equipment is Relatively Backward

China has made some provisions on modern vehicle inspection and maintenance technology, but mainly concentrated on parts standardization. At the same time, the situation of China's automobile industry's development level is lagging behind, which also affects the development of surrounding industries to a certain extent. Under the action, it has led to the backward situation of modern automobile inspection and maintenance technology equipment in China. Such as automatic diagnostic equipment, compared with equipment from developed countries such as Germany and Japan, China's automatic diagnostic equipment has poor reliability, low level of automation, and slow update, which is not very helpful for practical work. Many 4S stores have to pay heavily for foreign equipment, this issue deserves consideration from relevant departments in China.

2.2. Technical Theory is not Rich

In addition to the problem of backward equipment, modern automobile inspection and maintenance technology in China also has a lack of technical theory. Objectively speaking, China's automobile development history is short, and experience and technology have a certain gap compared with developed countries, lacking basic accumulation. As China gradually opened to the outside world at the end of the 20th century, a large number of foreign cars entered the Chinese market, which led to the limited development of China's national automobile industry, and the research power of technical theory was seriously insufficient. Under these factors, China's modern automobile detection and maintenance theory is out of touch with the development of the times, and it cannot provide sufficient guidance for practical work.

2.3. Insufficient Detection Means

In terms of testing methods, limited by equipment level and technical theory, some repair shops and personnel still use old-style methods when conducting modern vehicle testing, which reduces the effectiveness of testing and also has a serious impact on maintenance work. For example, the detection of engines, China generally uses post-installation experiments, a single experiment to understand its performance, still does not deviate from the traditional mode of visual inspection. Developed countries such as Germany often use virtual reality technology to repeatedly simulate, take the lead in understanding its feasibility and then conduct actual measurements, effectively ensuring the effectiveness of testing.

2.4. Lack of Effective Cultivating System

The practitioners in the modern automobile inspection and maintenance industry in China generally accumulate work experience through practice, gradually improve their ability, But the theoretical level is low. This leads to the disconnection between practice and theory, and essentially reflects the problem of imperfect cultivation system. Combining theory with practice can improve the effectiveness of work, and can also use the practice to enrich and improve the theory. The lack

of cultivating system leads to the imbalance of the growth of the employees in the modern automobile testing and maintenance industry in China. It also affected the progress of specific work.

3. Analysis and Future Development Trend of Automobile Inspection and Maintenance Technology

3.1. Intelligent Development

The implementation of vehicle inspection and maintenance technology must rely on the rational application of integrated equipment and automatic monitoring technology. When carrying out problem detection and fault location judgment, it is necessary to establish an intelligent equipment detection and identification system, so that the relevant inspection personnel can carry out inspection work more efficiently. Improve the positioning accuracy of the fault location, and take reasonable measures to deal with the situation in order to effectively enhance the automotive application effect. From the actual application effect analysis, the complete establishment of the intelligent system needs to further introduce the core role of external resources, which requires the relevant researchers to invest in the research of technological innovation. Starting from the actual national conditions of our country, we will design a corresponding intelligent system.

3.2. Both Hardware and Software Are Valued

Faced with the heavy hardware and light software that is currently prevalent in automobile inspection and maintenance work, it is necessary to reverse this misunderstanding as soon as possible and improve the emphasis on software technology, so as to lay a solid technology basis for improving vehicle inspection and maintenance technology. When strengthening the application of software technology, it can be implemented from the following aspects: (1) improving the vehicle inspection method; (2) improving the vehicle inspection system; (3) formulating and implementing the vehicle inspection certification specification; (4) based on the system integrity perspective, establish automotive application testing and maintenance technology.

3.3. Application Network Management

At present, in the field of automobile inspection and maintenance, the application of computer technology has become very extensive, and there are many types of computer unit sites in the system control process, which have very prominent differentiated features. In this regard, it is necessary to further enhance the network level of vehicle inspection management, and based on this basis, to ensure that the applied vehicle computer information can be well secured. At the same time, a corresponding information gathering site can be established to form a computer wide-area network system, which facilitates inspection and monitoring of vehicle application detection and maintenance technical means within the coverage area, identify vehicle safety hazards in a timely manner and tailor maintenance plans for them

3.4. Innovative Talent Needs and Training Objectives in the Automotive Industry

The continuous updating and advancement of high-tech means provides a good precondition for the production, manufacture and maintenance of automobiles. Applying high technology to the automotive service industry can continuously supplement the connotation of automotive services, and at the same time effectively drive the demand of the automotive service industry. Therefore, cultivating a large number of excellent automobile maintenance talents is an important demand in

the automotive industry market. At present, there are still serious shortages of the number of employees in the field of automobile inspection and maintenance. The maintenance personnel's own professional knowledge is scarce and the experience is not rich enough. Maintenance and innovation talents in the automotive industry need to be able to timely and effectively discover problems in the car in a short period of time, and actively and effectively adopt countermeasures to ensure and enhance the actual use of the car.

In the process of cultivating special innovative talents in the automotive industry, universities have played an active role and advantage. Under normal circumstances, the automotive testing and maintenance profession has been listed as a key course for colleges and universities, mainly to train students' automotive testing and maintenance expertise, to train students' practical skills, and to provide students with a good opportunity to participate in car testing and maintenance practice, to promote students to fully integrate basic theoretical knowledge and practical experience, to enrich students' experience in vehicle inspection and maintenance.

4. Investigation on the Status Quo of Innovation and Reform of Automobile Inspection and Maintenance Professional Technicians

4.1. Purpose of the Survey

Through the questionnaire survey the main measures for the innovation and reform of automotive inspection and maintenance professionals, mainly around the satisfaction of the current training model and the recommendations of the current training model, and through the analysis of the results to innovate and reform the automotive inspection and maintenance professional and technical personnel The main measures to provide relevant information basis.

4.2. Questionnaire Survey Development Steps

(1) Establishment of the survey site

This survey is aimed at the main measures for the innovation and reform of automobile inspection and maintenance professionals. In order to reduce the difficulty of carrying out survey activities, this survey is mainly carried out in this city, in order to facilitate the development of survey activities and ensure that enough survey results are done. Data is used as support, so it is determined that the location of the survey is the automobile inspection and maintenance major of the city's colleges and universities, and 3 colleges and universities with different reputations are randomly selected for the survey. Since this activity is mainly aimed at colleges and universities in the city, the results are not universal Therefore, the results of this time cannot explain the main measures for the innovation and reform of automobile inspection and maintenance professionals in other regions.

(2) Determination of relevant parameters

The establishment of the number of questionnaires is the most basic step of the survey activity, because the number of questionnaires is related to the validity of the survey results. If the number of questionnaires is set too low, the results of this survey will be questioned because the base of the data is not large enough, and the results of the survey are not large enough. It is universal. The number of questionnaires is set too high, and the difficulty of the questionnaire survey activity increases. Therefore, the number of questionnaires this time is set to 200 according to the minimum sample size proposed by the experts and the technical conditions of this survey.

(3) The distribution process of the questionnaire

The issuance of this questionnaire is mainly divided into two stages. The first is the issuance of the questionnaire, and the second is the recovery of the questionnaire. In order to ensure that the

results of this survey have greater authenticity, the recovery of the questionnaire will be completed after the questionnaire is issued. Recovered in the next six days, given time to fill out the questionnaire completely. 189 questionnaires were recovered, and the recovery rate this time was 95%.

4.3. Data Processing

(1) When performing correlation analysis on the collected data, the data must be classified and sorted. This will not only increase the utilization rate of the data, but also promote cross-data analysis. Therefore, the main consideration is the completeness and accuracy of the data. First of all, about data integrity. When the questionnaire is delivered to the sample subject for completion and collection, some sample items are arbitrarily completed, or their selection cannot be completed, which will cause some data sorting problems, but because the retrieved data accounts for the majority, So deleting the lost data means deleting the lost data. Secondly, the precision and accuracy of the data. When conducting an audit, the main consideration is to check whether these data are inconsistent with other choices, or the principle that conflicts with it should be selectively removed but retained as much as possible.

(2) The main meaning of a correlation relationship in the objective correlation analysis method is to generally refer to a certain relationship between various objective phenomena, but they are not strictly corresponding to each other in quantity. There are two main forms of determining the relevant properties of objective phenomena here: qualitative analysis and quantitative analysis. The main purpose of qualitative analysis is to rely on the scientific theoretical knowledge and practical experience of the researcher to accurately determine whether there are correlations between various objective phenomena. Or what kind of factor, the subjectivity of this analysis method is relatively strong. Among them, the commonly used calculation formula is expressed as:

$$r = \frac{S^2_{xy}}{S_x S_y} = \frac{\sum(x - \bar{x})(y - \bar{y})/n}{\sqrt{\sum(x - \bar{x})^2/n} \sqrt{\sum(y - \bar{y})^2/n}} \quad (1)$$

$$r = \frac{n \sum xy - \sum x \sum y}{\sqrt{n \sum x^2 - (\sum x)^2} \sqrt{n \sum y^2 - (\sum y)^2}} \quad (2)$$

5. Analysis of Survey Results

5.1. Satisfaction with the Current Reform Measures

The questionnaire is used to investigate students' satisfaction with the current reform measures. The results of the survey are shown in Table 1:

Table 1. Satisfaction with the current training model

	A college	B college	C college
Dissatisfied	42%	44%	43%
general	33%	32%	34%
satisfaction	25%	24%	23%

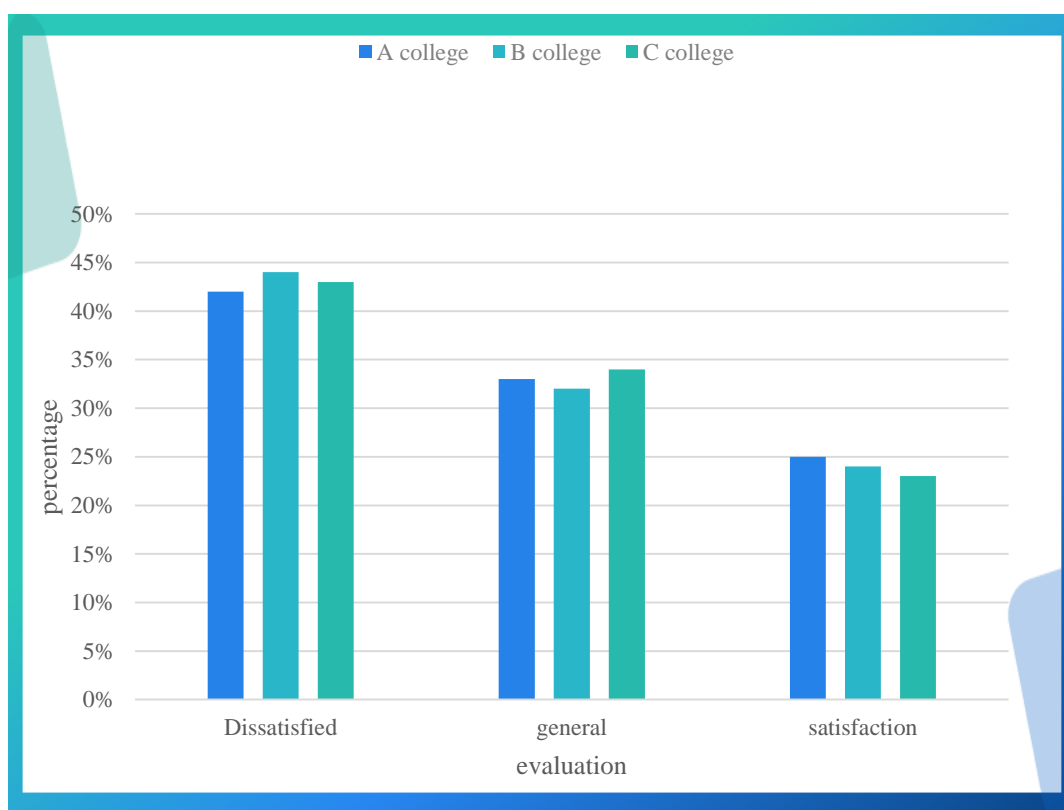


Figure 1. Satisfaction with the current training model

It can be seen from Figure 1 that the students are not satisfied with the current innovation and reform of automotive inspection and maintenance professional and technical personnel. The dissatisfied people accounted for more than 42%, and the average people accounted for about 32%. From this it appears that the reform of the current training model is necessary.

5.2. Suggestions for the Current Training Model

Through the questionnaire survey of students and teachers' suggestions on the reform of the training model, the results of the survey are shown in Table 2:

Table 2. Suggestions for the current training model

	A college	B college	C college
Teaching is determined by post, academic work alternates	45 %	46%	48%
Cooperation effectiveness needs to be improved	36%	33%	32%
Guidance to students in a timely manner	19%	21%	20%

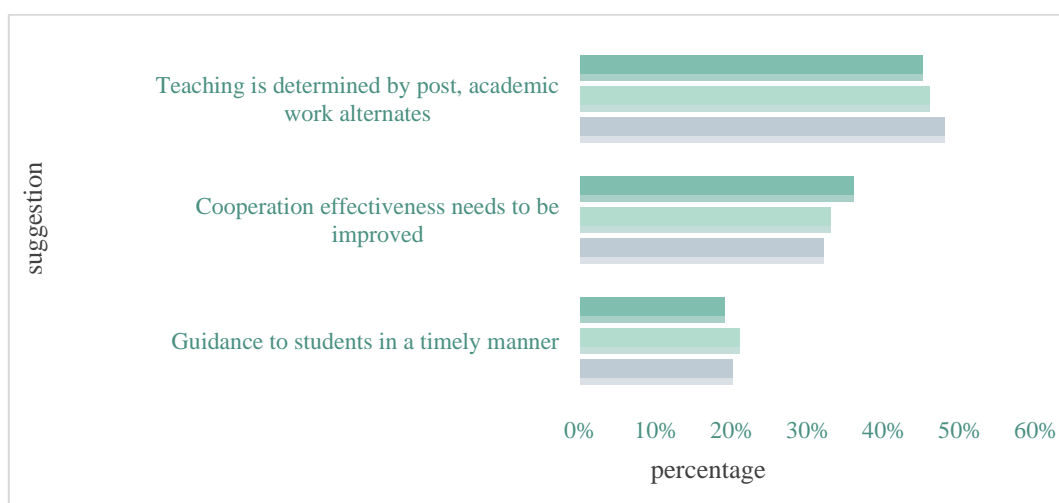


Figure 2. Suggestions for the current training model

It can be seen from Figure 2 that more than 45% of students and teachers in the suggestions given believe that schools should train talents based on the needs of the enterprise, rather than divorce the actual talent needs and emphasize theory rather than practice.

6. Construction and Implementation of the Course System of Automobile Inspection and Maintenance Technology Innovation and Entrepreneurship Education

College education is to train high-end skilled talents for the first line of production, construction, management and service, and the curriculum is the carrier to achieve the training objectives. According to the commonality and different characteristics of students, it is determined that the professional quality of students should be centered on, and the vocational ability of students should be emphasized. Therefore, the construction of the professional inspection and maintenance course system should be based on the innovation requirements of the automotive inspection and maintenance technology field and professional positions, refer to the national professional standards, innovate the curriculum and teaching content of the major, and build a vehicle detection maintenance of the professional curriculum system that meets the needs of innovation and entrepreneurship. It includes three modules: professional quality analysis and public courses, professional ability analysis and professional courses, scalable professional ability analysis and courses.

6.1. Implementation of Innovation and Entrepreneurship Curriculum Education

Adhere to the leading position of quality education and regard moral cultivation as the fundamental task of talent training. The public curriculum to cultivate the quality ability of college students accounts for 1 / 4 of the total academic hours, and the quality education is infiltrated into the whole process of new entrance education, professional theory teaching and practical teaching. At the same time, combined with the characteristics of each professional course, students are educated on ideological and political education, professional ethics education, professional quality education and career planning. Construct a modular theoretical teaching system and a project-based training system. Integrate more than 10 professional courses such as "Automobile Construction", "Automotive Diagnosis and Maintenance Technology" and "Automotive Detection Technology" in the automobile inspection and maintenance profession. According to the actual needs of innovation and entrepreneurship, build three modules based on machinery, and build a modular knowledge

system of theoretical education. At the same time, with reference to national professional standards, the training content of disassembly, maintenance, repair, diagnosis and testing of automobiles is set into a productive training project to form a projectization of the training teaching skill system.

6.2. Innovating Diversified Personnel Training Quality Evaluation System

In order to ensure the realization of the professional training objectives of automobile inspection and maintenance, the school and Geely Group jointly developed a complete quality evaluation system for personnel training. It includes content systems, standards systems and process monitoring systems. Cancel the traditional examination, examine the two assessment methods, and establish a multi-faceted and multi-faceted assessment that is composed of teachers, students, department leaders, school functional departments, graduates, employers, parents, etc., and the combination of on-campus learning and corporate practice evaluation System. Establish a variety of assessment methods such as A (process assessment), B (project assessment), C (practical assessment), and D (finished test). Teachers, students, department leaders, school functional departments, graduates, employers, parents, etc. can all participate as evaluation subjects in the evaluation and feedback of teaching quality, forming a multi-angle examination of teaching quality to ensure the objectivity and rationality of teaching quality evaluation

6.3. Strengthen the Cultivation of Innovative Talents

Strengthening the cultivation of innovative talents is the main measure to effectively improve the detection and maintenance technology of modern vehicles. Strictly speaking, there is no shortage of practical talents in China. The problem is that there is a clear disconnect between practice and theory in the industry. The development and the number of talents of the theoretical level are obviously unable to meet the requirements of practical work. Although there are many practical talents, it is impossible to form valuable theoretical results due to the theoretical level, and it has not played a proper role in promoting the overall development of the industry. In the follow-up work, a training base can be established to cultivate the practical ability of theoretical talents and the theoretical level of practical talents in the training base, and provide sufficient innovative talents for the modern automobile testing and maintenance industry.

7. Summary

Guided by innovation and entrepreneurship, we explored the training program for automotive inspection and maintenance technology professionals, and analyzed the relevant content by analyzing modern vehicle inspection and maintenance technology. Overall, the difference between modern car and traditional car inspection and maintenance is significant, which requires higher technical level and hardware conditions. At present, there are shortcomings in modern automobile inspection and maintenance technology, such as backward equipment and lack of technical theory. The detection methods and talent cultivation systems are not perfect enough. They can improve hardware equipment, enrich technical theories, optimize testing methods, and strengthen the cultivation of innovative talents. In the follow-up work, applying the above theory helps to avoid related problems and effectively strengthen modern vehicle inspection and maintenance technology.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

- [1] Wiseman A W. *Promises and Challenges for Innovation and Entrepreneurship in Education*. Emerald Group Publishing Limited, 2014. [https://doi.org/10.1108/S1479-3679\(2013\)0000023019](https://doi.org/10.1108/S1479-3679(2013)0000023019)
- [2] Feng W L, Yang X Z, Nie Y M, et al. *Problems and Countermeasures in Innovation and Entrepreneurship Education for Optoelectronic Majors*. *Time Education*, 2015.
- [3] Guang-Kai J I. *The Exploration of "Innovation and Entrepreneurship Education" for University Students*. *Research & Exploration in Laboratory*, 2016.
- [4] Yang H, Fu X. *Research on Innovation and Entrepreneurship Education for College Students of Electronic and Information Majors*. *International Conference on Information Technology in Medicine and Education*. IEEE, 2017:701-704.
- [5] Liang P, Li C. *Research on the Education Mode of "Innovation and Entrepreneurship" Based on Internet*. *Electronic Test*, 2016.
- [6] Ding Y Y. *The constraints of innovation and entrepreneurship education for university students*. *Journal of Interdisciplinary Mathematics*, 2017, 20(6-7):1431-1434. <https://doi.org/10.1080/09720502.2017.1382152>
- [7] Liu J, Liu H L, Huang X P. *Research and Practice for Innovation and Entrepreneurship Education from Applied University: In Mechanical and Electronic Engineering*. *Value Engineering*, 2016.
- [8] He J, Liu X. *Research on Collaborative Information Service of University Libraries for Innovation and Entrepreneurship Education*. *Higher Agricultural Education*, 2017.
- [9] Yang C X, Zhang J, Jun W U, et al. *Questionnaire Analysis Report on Innovation and Entrepreneurship Education for Vocational College Students*. *Journal of Xian University*, 2015.
- [10] Niu S P. *An Analysis of the Deepened Educational Reform for Innovation and Entrepreneurship in Private Universities—A Case Study Based on Shanxi Technology and Business University*. *Theory & Practice of Education*, 2016.
- [11] Huang Z J, University F S. *Research on the Role of College Communist Youth League in Promoting Innovation and Entrepreneurship Education for College Students*. *Journal of Hubei Correspondence University*, 2017.
- [12] Ketikidis P H, Sotiriadou A, Hatzia Apostolou T, et al. *Fusing Technology, Innovation and Entrepreneurship into Postgraduate Education*. *European Conference on Innovation and Entrepreneurship*. 2012.
- [13] Hu J, Huang Q. *Exploration and Practice on Innovation and Entrepreneurship Education for Agricultural and Forestry University Students*. *International Conference on Social Science, Education Management and Sports Education*. 2015. <https://doi.org/10.2991/ssense-15.2015.29>
- [14] Yang S, Yang Y. *Research on Construction of Curriculum System and Teaching Staff for Innovation and Entrepreneurship Education*. 2017(mess). <https://doi.org/10.12783/dtssehs/mess2017/12180>