Proceedings of ICEIPI 2025 Symposium: AI Am Ready: Artificial Intelligence as Pedagogical Scaffold
DOI: 10.54254/2753-7048/2025.CB24948

Teaching Reform of Automotive Engineering Major Oriented Towards the Cultivation of Students' Abilities

Jiaqi Chen

School of Mechanical and Automotive Engineering, Shanghai University of Engineering Science, Shanghai, China
cjq192711@outlook.com

Abstract. With the continuous rise of emerging technology industries, as well as the constantly changing and evolving market demands in professional fields, the backwardness of ability will become an important factor in facing unemployment. Whether it is a large enterprise or a national strategic demand, the requirement for capability is gradually shifting from simply following concepts and principles to integrating multiple types of knowledge for innovation. Therefore, in the cultivation of professional talents, the focus will shift towards the improvement of various abilities. This paper focuses on the Automotive Engineering major, and in response to the needs of the current technological environment, sorts out and analyzes the deficiencies of the current higher education system, and conducts a systematic analysis and methodological suggestions around the cultivation of the abilities required by college students. Through the analysis and discussion of the four core abilities, including practical innovation ability, the ability to apply interdisciplinary knowledge, professional ethics ability, and English ability, it further provides references for improving the teaching content and teaching methods of the automotive engineering major.

Keywords: automotive engineering, professional ability, college students, teaching reform

1. Introduction

In this period of rapid development of science and technology, major technological changes have enabled people to obtain huge social and economic benefits from them. Meanwhile, the rise of emerging technologies may also pose a huge challenge to the employment environment. In the field of engineering, with the continuous update of technology, a series of artificial intelligence will replace the jobs of existing workers. This does not mean that workers will lose their job opportunities as a result, because intelligent manufacturing has replaced the original jobs and will also give rise to many new opportunities, most of which are in areas that artificial intelligence cannot reach at present. Today's workers are not necessarily lacking in skills, but new workplaces often require skills that they do not possess. The demand for these skills is the incentive that creates opportunities [1].

Therefore, professionals with low quality are very likely to be eliminated in this fast-paced and fierce competition and thus lose their jobs. To deal with this situation, continuous high-quality professional skills training is an important means to alleviate and prevent this "unemployment

© 2026 The Authors. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

DOI: 10.54254/2753-7048/2025.CB24948

wave". As for universities that cultivate professional and technical personnel, the reforms in educational content and methods play a crucial role in talent cultivation. The educational environment during university will determine an individual's career development prospects [2]. Against the backdrop of artificial intelligence, with the development of the intelligent automotive industry, many problems buried in professional courses have gradually come to light. For instance, the scope of students' professional courses is narrow, the types of courses are limited, the curriculum system is relatively outdated, and the cultivation of practical abilities is insufficient etc. These problems still exist widely in today's university courses [3].

Of course, blindly reforming the teaching content and methods without combining them with the current employment trend and the demand for professional talents from various enterprises and national policies will only become empty shells. From the perspective of the current situation, the demand for talent ability from major enterprises and national policies, the practical innovation ability, interdisciplinary knowledge application ability, professional ethics ability, and even English ability of fresh graduates are the focus of examination and evaluation. So, universities should carry out a series of teaching reforms around the cultivation of these abilities.

2. The cultivation of college students' abilities based on the demands of the engineering field

2.1. Practical innovation ability

For the academic completion of college students, most universities take written examinations as the evaluation criterion, which leads to many college students and teachers focusing more on the theoretical aspect of the content taught in the classroom. Some parts of the experiments may be completed with the assistance of teachers or even directly omitted. This limits college students' essential practical and innovative abilities in the field of engineering and technology.

A study shows that when some fresh graduates first enter the job market, 53% of the students are not well-prepared for industrial practice before leaving it, and 12% of the students don't even understand the process of industrial practice. This also indicates that the lack of practical innovation ability will intensify the difficulty of future work. Even more so, due to the fact that practical operations were not supplemented during the theoretical learning process at that time, the content of the previous theoretical learning could not be well understood and absorbed, resulting in forgetting in the future [4]. Therefore, the cultivation of practical innovation ability is an indispensable part of teaching.

2.2. The ability to apply interdisciplinary knowledge

Under the current background of artificial intelligence, the traditional curriculum system of automotive engineering can no longer adapt to the comprehensive development of artificial intelligence in the automotive industry. At present, the curriculum system of the vehicle engineering major in colleges and universities still mainly consists of the most basic general education courses and discipline and professional basic courses. The types of curriculum Settings are single, and the knowledge scope involved in professional courses is narrow, which limits students in terms of course selection and knowledge acquisition, thus resulting in one-sided knowledge mastery. Some students do not have a systematic understanding and cognition of knowledge in non-major disciplines. They even think that interdisciplinary knowledge is not necessary and thus neglect this aspect of learning and understanding. This has led to a decline in students' enthusiasm for learning interdisciplinary knowledge [3]. Therefore, how to motivate students' enthusiasm for learning

DOI: 10.54254/2753-7048/2025.CB24948

interdisciplinary knowledge and the issue of professional curriculum setting are the key points that should be focused on in the current teaching reform.

2.3. Professional ethics ability

Due to the relaxed atmosphere of daily academic study in university, many students do not have a systematic understanding of their major, but simplify their professional cognition. Some students may even transfer the attitude they have towards their studies in college to their future professional positions, which may lead to a series of hidden dangers when they work in the future. Especially in the field of engineering, whether it is a mechanical major like vehicle engineering or a civil engineering major like architecture, one must have a clear understanding and attitude towards each major, and must pass the professional ethics test. However, the fact is that many universities have simplified and omitted the introduction of this major to a certain extent, which is why many students have a vague understanding of the major. Therefore, the cultivation of professional ethics ability should be placed at the top of all ability cultivation.

2.4. English ability

In the daily teaching process, English ability is often classified within interdisciplinary knowledge. In fact, English ability has gradually become a part of the study of the automotive engineering major nowadays. Some studies show that poor oral English expression is the main problem that many students majoring in automotive engineering encounter in practical applications. The reasons may be that students do not fully integrate and understand the English context, and partly it may also be due to their insufficient vocabulary reserves. This language barrier affects students' confidence in cross-cultural communication, and thus may further impact the cultivation and mobility of talents in related industries [5].

However, at present, in the setting of courses for the automotive engineering major, the courses of oral English and English reading are often placed in the position of general basic education courses instead of being integrated into the professional courses. This may lead to a strong sense of disconnection between the learning of English and the learning of professional knowledge. The separation of teaching for a long time may cause certain difficulties when facing a job position in the future, such as reading relevant English literature and purchasing or searching for related items. Therefore, the cultivation of English ability cannot be ignored.

3. Teaching reform methods for cultivating various abilities

3.1. Practical innovation ability

In the continuous transformation and upgrading of the automotive industry, cars are no longer merely mechanical transportation methods; they are evolving into intelligent mobile Spaces, energy storage units, and digital platforms. In order to adapt to these trends, all major vehicle-related majors must cultivate professional talents who are good at practical ability and have a strong sense of innovation [6].

3.1.1. Teaching reform in terms of practical ability

The integration of production and education is one of the methods to enhance students' practical abilities. The school authorities can closely cooperate with some official partner enterprises or

DOI: 10.54254/2753-7048/2025.CB24948

national-level vehicle-related enterprises. The combination of schools and enterprises can achieve the effect of complementary advantages [7]. Students can conduct theoretical studies related to their majors at school and gain a general understanding of actual industrial production operations through simulation equipment in the laboratory, which is conducive to enhancing their familiarity with practical operations in the future. Enterprise experts entered the classroom to explain the current situation of vehicle development to college students, and at the same time allowed students to visit some industrial production links in the enterprise. This can not only enhance students' understanding of actual industrial production, but also increase the interest of some students in their own majors.

Project-based learning (PBL) is also one of the ways to enhance students' practical abilities. This is a method that has been proven to be highly effective. It can enhance students' enthusiasm for active learning and practical abilities, thereby helping them better understand and master the knowledge and skills of automotive engineering. This will further lay a solid foundation for future work in related industries [8].

3.1.2. Teaching reform in terms of innovation ability

The online and offline flipped class model is one of the ways to enhance students' innovation ability. This is a teaching method that integrates the advantages of online teaching and offline classrooms. Students can more conveniently and freely search for and study the literature and materials related to the assigned experimental content on the Internet, and present their design achievements in class. Most importantly, during this process, students' teamwork ability and independent thinking ability can be enhanced. The improvement and adjustment of the scheme in the experiment, as well as the collection and analysis of the final data, all contribute to the enhancement of the innovation ability [9].

Furthermore, the reform of teaching content and teaching methods is highly related to the development of students' innovative ability. With the support of relevant policies and technological innovations, the technology of new energy vehicles has developed rapidly. The traditional course on the structure of automotive engines can no longer keep up with the current trend of technological development. The outdated teaching content has led to a serious disconnection between classroom teaching and the actual development and demands of enterprises. Therefore, the content of textbooks should keep pace with the times and combine practice with theory. Teaching methodologies need to transition from singular didactic approaches to those that foster students' capacity for applying learned concepts to resolve actual problems [10].

3.2. The methods for enhancing the ability to apply interdisciplinary knowledge

Many college students are not sensitive to the connections between professional disciplines, so interdisciplinary teaching cooperation has become the main way to enhance this. Through exchanges and cooperation among schools and institutions from different regions and fields, the sharing of teaching resources is achieved, providing students with a large number of subject knowledge platforms and training opportunities that they cannot come into contact with or have never known before, thereby enhancing students' ability to apply interdisciplinary knowledge [11].

Meanwhile, in order to enhance students' ability to apply interdisciplinary knowledge, a series of reforms can also be carried out for general professional basic courses and professional courses. For example, some repetitive content in the original course is partially deleted. The class hours of this part are reduced, and some interdisciplinary knowledge content is updated and added [12].

DOI: 10.54254/2753-7048/2025.CB24948

3.3. Teaching reform based on students' professional ethics ability

The most important point regarding the improvement of students' professional ethics ability is the change of teaching assessment and evaluation methods. The traditional way of judging students' high and low scores in written examinations cannot comprehensively and objectively evaluate students. Some students who study regularly end up achieving lower exam scores than those who get high scores through last-minute cramming. However, the level of examination results cannot guarantee one's mastery of the knowledge in the professional field with 100% certainty. Therefore, the focus of daily teaching should be on the interaction with students in daily teaching. At the same time, artificial intelligence technology can also be utilized, which can, to a certain extent, improve students' process and comprehensive evaluation scores, and also make up for some of the instability of manual evaluation [13].

Meanwhile, it is necessary to actively carry out daily publicity lectures on the connection between vehicle-related professional courses and their professional employment positions and real life,to help students perceive the knowledge demands and professional status under the trend of automotive transformation. One point that should be given more attention is that in courses such as mechanical disassembly and assembly, special care should be taken when introducing the usage norms of precautions for disassembly and installation, and the concept of safety first should be conveyed and emphasized to students [14].

3.4. Suggestions for the teaching reform of english ability of automotive engineering students

For the improvement of the English ability of automotive engineering students, the theoretical method of Production Oriented Approach (POA) can be adopted. The curriculum is designed based on the unique task goals and internship environment of this major, that is, simulating the actual working scenarios and using English for introduction, communication, and discussion. According to the different teaching requirements of various professional courses, some teaching content can be taught in English. Of course, this also puts forward certain requirements for the teaching talent resources of related majors. In the future, when hiring teachers, selection can also be conducted in this aspect [5].

4. Conclusions

In this era of rapid technological evolution, whether it is automotive engineering or other professional fields, the requirements for different capabilities in their respective fields are also constantly changing. If teaching reform is not carried out based on the ability requirements of professional talents, the consequence can only be facing a large number of unemployed and a shortage of talent. For the cultivation of talent capabilities, practical innovation ability, interdisciplinary knowledge application ability, professional ethics ability, and English ability are the absolute abilities among all that can keep an individual's comprehensive strength at a peak for a long time.

Teaching reform is not something that can be achieved overnight. Universities should carry out corresponding teaching reforms in response to different situations in different periods, the demands of various enterprises, as well as the requirements of social changes and national policies. Based on some suggestions for measures and methods of teaching reform in this article, it may have certain timeliness and unfeasibility for universities in some regions. Therefore, the key to teaching reform lies in adapting to changes in the environment and current affairs.

DOI: 10.54254/2753-7048/2025.CB24948

References

[1] Kuntadi, I., Trisno, B., Ratnata, I. W., Sukadi, S., & Sriyono, S. (2020, April). Potential and prospect analysis of the labor market in education in the fields of renewable energy engineering, industrial automation and robotics, and automotive engineering. In IOP Conference Series: Materials Science and Engineering (Vol. 830, No. 3, p. 032058). IOP Publishing.
[2] Curiel-Ramirez, L. A., Bautista-Montesano, R., Galluzzi, R., Izquierdo-Reyes, J., Ramírez-Mendoza, R. A., & Bustamante-Bello, R. (2022). Smart automotive e-mobility—A proposal for a new curriculum for engineering education. Education Sciences, 12(5), 316.
[3] Zhu, X. (2021). Research on the reform of higher automotive engineering education in the background of artificial intelligence. In E3S Web of Conferences (Vol. 245, p. 03091). EDP Sciences.
[4] Suyitno, S., Sudarsono, B., & Jatmoko, D. (2019). Evaluation of the implementation of industrial practice learning in automotive students. In Proceedings of the 2nd International Conference on Education (ICE 2019), 27–28 September 2019, Universitas Muhammadiyah Purworejo, Indonesia.
[5] Yu, J. (2024). Course design for improving oral communication ability in automotive English under POA theory. Transactions on Comparative Education, 6, 63–72.
[6] Li, Y., & Du, N. (2024). Design and application of the VAC teaching method oriented towards the transformation of the automotive industry. Higher Education and Practice, 1(8).
[7] Wang, W., & Yan, Y. (2024). Research on cultivating practical innovation ability of vehicle engineering master students with integration of production and education.
[8] Zhou, S. (2023). Research on the effectiveness of project-based learning in automotive engineering teaching. Advances in Educational Technology and Psychology, 7(17).
[9] Jiang, W., & Zai, W. (2022). Construction and research of the practical teaching system of vehicle engineering major based on the concept of "New Engineering".
[10] Yan, F., Li, X., & Zhang, Z. (2024). Exploration of automobile engine structure course reform under the background of new energy vehicles development. Curriculum and Teaching Methodology, 7(5).
[11] Wang, J., Wang, J., Ding, J., & Luo, W. (2025). Research on the coculture model of vehicle engineering graduate students under the concept of innovative coordination and open sharing. International Journal of Social Science and Education Research, 8(5), 281–287.
[12] Yang, R. (2020). Research on the teaching reform of automobile structure course for vehicle engineering major.
[13] Liu, J., Li, Y., & Shi, Y. (2024). Research on the teaching reform path of automotive service engineering based on artificial intelligence application. Applied Mathematics and Nonlinear Sciences, 9(1).
[14] Yang, R. (2020). Research on the teaching reform of automobile disassembly and installation course for vehicle engineering major.