Region - Educational Research and Reviews, 2025, Volume 7, Issue 9
DOI: 10.32629/rerr.v7i9.4351
ISSN Online: 2661-4634
ISSN Print: 2661-4626

Exploration of teaching reform in industrial engineering major guided by social needs

Yuhong TAI, Qinming LIU, Tianyu TANG

Department of Industrial Engineering, Business School, University of Shanghai for Science & Technology, Shanghai 200093, China

Abstract: Guided by social needs is an inevitable trend in the development of university teaching. Based on the new situation of the development of industrial engineering majors, this paper analyzes the problems in teaching, proposes reform strategies for course teaching and experimental practice teaching guided by social needs, as well as methods for building teacher teams, and proposes the implementation of a new 3+X teaching model. This has a certain improvement effect on the teaching effectiveness and experimental practice level of industrial engineering courses in universities, as well as good guidance and reference significance.

Keywords: industrial engineering; social demand orientation; reform in education; practice base

1 Introduction

In the context of economic globalization, China's market economy has achieved rapid development, promoting the sustainable development of China's manufacturing industry, and placing higher demands on the quantity and ability of industrial engineering talents [1][2]. Therefore, in the face of the increasing demand for talent and the dilemma of graduates becoming unemployed upon graduation, Chinese universities should be guided by social needs in the process of training industrial engineering talents, accelerate the reform of industrial engineering teaching, cultivate application-oriented and high-level talents with international perspectives and innovative and creative abilities, and meet the needs of manufacturing development.

At present, the teaching mode guided by social needs is not compatible with professional teaching modes, and the difficulty of effective implementation is relatively high. In recent years, the enrollment scale of Chinese universities has rapidly expanded. Although the corresponding educational conditions, teaching models, and research levels have been continuously improved and perfected, they still lag behind the expansion of scale, and the level of experimental and practical teaching lags behind the development of corresponding technologies [3]. With the sudden outbreak of the economic crisis and China's industrial adjustment and economic transformation, higher level requirements have been put forward for the practical and innovative abilities of college students. However, the current professional talent cultivation system in universities struggles to meet the diverse and evolving needs of society, leading to significant challenges in teaching reform [4]. In addition, as more and more graduates enter the market, the unemployment rate is rapidly increasing. Coupled with the poor comprehensive application ability of graduates, they are also unable to immediately apply for suitable jobs after graduation. The traditional teaching and training model is becoming increasingly difficult to solve this contradiction. Instead, we need to overcome our own teaching shortcomings, focus on meeting social needs, transform the

traditional training model that emphasizes theory over practice, reform the professional experimental practice teaching model, and develop a new training model with "ability over application" as the core. This article takes the training of industrial engineering majors at Shanghai University of Technology as an example, proposes a reform method that combines professional ability training with practical base application guided by social demand, and puts forward a reform idea of implementing 3+X teaching.

2 Shortcomings in the teaching of industrial engineering

(1) Most teachers are burdened with heavy theoretical teaching and neglect the connections between courses. The knowledge system of industrial engineering is often comprehensive and highly interdisciplinary, closely related to courses such as human factors, facility planning, production planning, etc [5][6]. However, in actual teaching, teachers overlook the interdisciplinary nature of curricula and the role of comprehensive course understanding in the professional knowledge system, resulting in students' comprehension of specialized knowledge remaining superficial, while their practical knowledge application ability will be poor, and their comprehensive ability will not be effectively improved comprehensively.

(2) The systematic and comprehensive nature of the experimental teaching system is not strong. Many professional knowledge points repeatedly appear in some course experiments, and for the repeated professional knowledge points, they are only superficially explored during the experimental teaching process. This streaming experimental teaching model lacks systematic coherence, hindering students from developing a comprehensive knowledge framework. In addition, the traditional experimental teaching mode is based on the application of single course professional knowledge points. Although students have gained an understanding and mastery of applying single course knowledge points through experiments, they lack the ability to integrate and coordinate different knowledge points, which makes it difficult to use experiments to improve students' problem-solving abilities.

(3) The practical teaching conditions are backward, the practical teaching mode is single, and there is a lack of strong practical teams. The construction of practical teaching resources is outdated, which cannot meet the needs of teachers in practical teaching. There is also a lack of effective platforms for students' professional and comprehensive practice, making it difficult to improve their knowledge application ability. The traditional teaching model of "production internship course design graduation project" is mostly completed on campus and has not been integrated into enterprises according to social needs, which is disconnected from the actual needs of society. In addition, most teachers are directly engaged in teaching work after graduation, lacking specialized training in practice, making it difficult to build a strong faculty for practice-based teaching.

3 Reform of course teaching guided by social needs

The characteristics of innovation, applicability, and comprehensiveness in teaching guided by social needs require the teaching process to transform from an independent, decentralized, and closed architecture system to an interdisciplinary, centralized, and open comprehensive system, and from emphasizing classroom teaching to paying more attention to experimental and practical teaching [7]. In the teaching and experimental practice of industrial engineering major, improvements can be made in the following aspects:

(1) Establish a horizontal and vertical connection between course teaching and experimental teaching. Taking professional courses as the main line, we should reform the curriculum design, analyze whether there are duplicate but unimportant experimental contents in existing professional courses, and address these issues, as well as redefine the arrangement of course teaching content and experimental teaching to establish a horizontal connection between course teaching and experimental teaching. At the same time, experimental teaching is interconnected, such as human factors,

three-dimensional warehouses, facility planning, logistics, production lines, etc., all of which have a temporal continuity. During the experimental process, students gradually deepen their understanding and application of professional knowledge, and can better master the entire experimental system. This vertical arrangement of course teaching and experimental teaching makes it easier for students to master industrial engineering professional knowledge and skills, serving practical needs.

(2) Guided by social needs, improve practical teaching conditions by building practical platforms and bases. By integrating with alumni enterprises, universities can establish a practical base for professional students. Through expanding industry-university research cooperation, the university can construct practical platforms such as joint laboratories, simulation workshops, innovative research and development centers, fundamentally improving the practical teaching process, and achieving the goal of co-building and mutual benefit with enterprise resources. For example, the School of Management of Shanghai University of Technology and Shanghai Pangyuan Machinery Leasing Co., Ltd. jointly established a practical base for industrial engineering majors, adopting the method of student rotation practice. The first batch of students has achieved certain results, demonstrating high enthusiasm and generating significant income.

(3) Establish an experimental and practical teaching team. To achieve teaching reform guided by social needs, it is necessary to build teaching teams with strong experimental and practical abilities, cultivate dual teacher teaching teams, and jointly establish teacher experimental and practical bases with schools and enterprises to jointly cultivate young teachers; On the other hand, the teaching and experimental-practical abilities of young teachers should be developed in both directions, and they should be sent to enterprises for training. At the same time, outstanding talents in the business world with rich practical experience should be invited to guide students. Through dual-faceted training, a comprehensive teaching team with strong teaching and experimental-practical abilities can be established, thereby ensuring the realization of high-quality curriculum teaching and experimental practical teaching.

4 Implementation of the 3+X teaching model

For the new teaching mode, the 3+X mode is adopted, which includes instruction mode, experimental mode, practical mode, and teaching reflection mode, breaking the isolation of traditional single-mode teaching and fostering collaborative learning. Firstly, through international exchanges and cooperation, we can absorb and learn from the successful teaching experiences of various countries, introduce excellent teaching models, and strengthen exchanges with teachers in the same field from domestic universities to improve the teaching level of industrial engineering majors. Secondly, the industrial engineering major is a discipline that integrates course teaching and experimental practice teaching. Teaching experiments are the prerequisite for effectively innovating and applying professional knowledge in practice. The 3+X mode has established an experimental teaching system centered on the cultivation of innovation ability and building hierarchical experiments: basic knowledge verification experimental teaching, comprehensive experimental teaching and independent innovation experimental teaching. Through three levels of experimental training, students' comprehensive abilities are improved. Once again, universities can further focus on establishing enterprise practice bases to create off-campus platforms for student ability development, gradually improving the construction of practice bases with enterprises according to the training objectives of industrial engineering major, while standardizing and improving the management and evaluation of bases. Outstanding talents from enterprises may be hired as part-time instructors to complement full-time faculty in practical teaching. This arrangement enables students to better understand the actual social situation, ensuring a seamless integration of courses and experiments, thereby enhancing teaching effectiveness. Finally, through post-class reflections on course instruction, experimental teaching, and practical teaching, we continuously explore and solve our own teaching problems through action research, unify "learning to teach" and "learning to learn", striving to improve the

rationality of teaching practices and evolve into well-rounded educators. By implementing the 3+X model, we elevate the teaching standards and experimental practice level of industrial engineering majors.

5 Conclusion

Aligning with social requirements, this study proposes a comprehensive reform framework for industrial engineering education, integrating pedagogical innovation with practice-oriented strategies. This article combines the current situation of industrial engineering courses and experimental practice teaching in various universities. Based on the professional training plan and social needs, it redesigns the cultivation of professional abilities, affirms the necessity of building practical bases, and reforms teaching methods and techniques. To meet the actual needs of industrial engineering majors, we should improve the teaching forms, update and perfect teaching content, strengthen the development of teacher team building, engage in relevant practical work to enhance practical experience. In addition, the 3+X teaching model has been proposed, wherein course instruction builds students' professional knowledge, experimental teaching stimulates students' interest in learning, and practical teaching improves students' innovation and application abilities. It truly plays the role of promoting experiments through courses and promoting practice through experiments, cultivating industrial engineering professionals that meet the needs of society.

Acknowledgments

The work presented in this paper has been supported by grants from 2023 University of Shanghai for Science and Technology Undergraduate Teaching Research and Reform Project (JGXM202318): Exploration and Practice of Industrial Engineering Applied Talent Cultivation System for Innovation and Entrepreneurship Demand.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Hu KS, Li S, Zhao SY, et al. 2012. Research on the positioning and talent training model of industrial engineering major. *Journal of Dongguan University of Technology*, 19(1): 109-112.

[2] Zhu LS, Wang HM, Liu QQ. 2010. Exploration of teaching reform in applied undergraduate colleges based on social demand orientation. *Educational Theory and Practice*, 30(2): 6-7

[3] Geng XL, Ye CM. 2014. Exploration of teaching reform in industrial engineering for the integration of science and education. *Education and Teaching Forum*, 46: 159-161

[4] Xue DJ, Pan LL, Pan Y, et al. 2011. Research on practical teaching of applied industrial engineering talent cultivation. *Equipment Manufacturing Technology*, 2: 163-168.

[5] Guo W. 2004. Positioning of forward looking industrial engineering. *Industrial Engineering and Management*, 1: 1-3.

[6] Li F, Ye CM. 2009. Exploration of teaching system reform in production and operation management. *Industrial Engineering*, 12(4): 135-137.

[7] Yang XY, Han JH, Fan WF. 2007. Research on the positioning and talent cultivation mode of industrial engineering major. *Higher Education Management*, 1(1): 89-92.