Study on the Teaching Reform of "Traffic Information Detection and Processing" Course in the Era of Intelligent Transportation

Tian Lei, Xiaohong Yin(✉), Lei Gong, Qin Luo, Zihao Lei, and Xuru Li

Shenzhen Technology University, Shenzhen 518000, Guangdong, China
{leitian,yinxiaohong,gonglei,luoqin}@sztu.edu.cn,
li.xu.ru@foxmail.com

Abstract. With the rapid development of Intelligent Transportation Systems (ITS), "Traffic Information Detection and Processing" becomes an essential course for colleges with transportation majors. Although the importance of such courses has been addressed in recent years, there still exists some unaddressed problems in obtaining good teaching effects. In the present work, the trend and possibility of teaching reform for "Traffic Information Detection and Processing" related courses in terms of teaching content, teaching methods as well as assessment methods are summarized through a comprehensive analysis of existing studies and major orientations of teaching reform for such courses are clarified. The outcomes of the present work point out the direction for future teaching reform of "Traffic Information Detection and Processing" Course in the Era of Intelligent Transportation.

Keywords: Traffic Information Detection and Processing · teaching reform · teaching content · teaching methods

1 Background

Intelligent Transportation Systems (ITS) and Vehicle-road Cooperation are one of the hot spots in the current transportation field. ITS improves transportation safety and mobility through applying well-established information technology, sensing technology, computer processing technology, data communication technology and electronic automatic control technology to transportation systems. Among all these procedures, the rapid acquisition and processing of traffic information is the key to realize the functions of ITS [1, 2]. In recent years, the rapid development of intelligent perception and data processing technology has made the new technology widely used in transportation field, and the intelligent traffic information detection and processing system has entered the application level of urban traffic management in my country [3, 4]. With such background, the course "Traffic Information Detection and Processing" has become a professional core course for students in Transportation Engineering, which aims at cultivating professional talents with comprehensive capabilities of modern and scientific intelligent

C. F. Peng et al. (Eds.): MMET 2022, ASSEHR 703, pp. 262–268, 2023.
https://doi.org/10.2991/978-2-494069-51-0_36

transportation design, management and application. In the setting of the course, special attention is paid on the teaching of practical skills and the ability to collect and process road traffic information. With the rapid development and application of urban intelligent transportation technology, the requirements for information collection and preprocessing technology for transportation majors are gradually increasing, and the requirements for the training of professional application-oriented talents are also constantly advancing with the times. The relevant practical content of this course and teaching methods also need to be optimized and updated in time.

Overseas colleges and universities offer courses on traffic information detection and processing, commonly known as "Transport Data collection and Analysis", which are mostly set up in engineering colleges and related majors such as transportation or electrical and electronic engineering [5, 6]. With the rapid development of intelligent transportation technology, domestic colleges and universities are becoming more and more aware of the importance of information detection and processing, gradually increasing the emphasis on similar courses and opening related courses one after another. For instance, the School of Transportation and Automotive Engineering in Southwest Jiaotong University offered a course called "Road Traffic Information Detection Technology" [7] and Chang'an University offered a course called "Modern Road Traffic Testing Technology" [8].

Although main goal of these courses is to train the students with basic theories and methods of traffic information detection through theoretical teaching, extracurricular homework and experiments, there still exists some unsolved problems in terms of obtaining good teaching effects and cultivating well-trained students in intelligent transportation. First, although practical teaching method is introduced in these courses, the emphasis on practical teaching in these courses is not sufficient. Moreover, such courses require certain knowledge in sensing and transportation as a basis, however, such links between different knowledge modules are not well addressed in existing setting of these courses. Therefore, it is necessary to continuously optimize and update teaching methods for such course to improve the knowledge system of undergraduates majoring in transportation and cultivate the professional quality of intelligent transportation in the new era.

As to such situation, the present work aims at summarizing the direction of the teaching mode reform for these courses through a comprehensive analysis of existing literatures and coming up with the key issues need to be solved in future teaching. The conclusion obtained in the present work could also provide reference for information and processing related courses in fields other than transportation.

2 Teaching Content Reform

The teaching content for "Traffic Information Detection and Processing" involves advanced information technology, electronic sensing technology, data communication and transmission technology, electronic control technology and computer processing technology. For such a comprehensive course, one major concentration in the reform of teaching content in recent years is to enrich the teaching samples.

In information detection related courses, Shi Chaoyi et al. [9] proposed to expand teaching samples in the practical teaching of "Signal Detection Technology" course

through refining the industry-university research projects into a number of practical topics as teaching examples. Han Fang et al. [10] developed diversity virtual-reality teaching samples with multi-disciplinary backgrounds involving measurement and control, electromechanical transmission, signal processing, etc. Zhu Weixia et al. [11] proposed a systematic theoretical guidance and practical experience of the course through a project example of targeting detection AI application based on python deep learning, which solves the difficult problem of teaching AI courses. Xiu Junshan et al. [12] extended the practical course samples through exposing the students to the latest knowledge with online means.

While for the area of information processing, many studies also proposed to enrich teaching samples to stimulate students' learning interests and improve the teaching effects. Jiang Wen et al. [13] proposed to increase engineering related teaching examples so that to help students grasp the correct connotation, intuitive meaning, and conditions for applying knowledge. Zhang Mei et al. [14] argued that scientific research in related area can be infused into the teaching content to enrich the teaching samples so that the students keep abreast of the developments and trends in the discipline of their majors. Wu Di et al. [15] believe that four principles should be followed in the design of teaching samples: case inspiration, case interactivity, case expansion, and case teaching interactivity, as a way to enhance the interactive communication between teachers and students, and between students and students. Xu Jie et al. [16] proposed to modularize interconnected teaching samples using condensed teaching contents so that to facilitate the students to organize and categorize the content system, and synchronized the practical application in the modularized teaching to promote the unity of learning and application. Luo Chaoming et al. [17] adjusted the curriculum standards of the course cluster through combining application teaching samples with theoretical teaching of basic concepts and basic laws.

As can be summarized from the related studies, enriching the teaching samples is an inevitable trend in the reform of information detection and processing related courses. Within these studies, setting project-based practical teaching samples, modularizing the teaching samples and construction of course groups are preferable practice for the reform of teaching contents for information detection and processing related courses.

3 Teaching Method Reform

Besides teaching content reform, much attention has been paid on the teaching method reform for information detection and processing related courses. Several major points in improving the teaching methods can be summarized.

Emphasizing Practical Teaching. While discussing how to improve the teaching effects, many studies pointed out that increasing practical teaching sections is critical. Huang Gang et al. [18] proposed to construct a narrative teaching situation for information detection experimental projects under real or near-real actual conditions so that the students have a more intuitive feeling. Xu Lichao et al. [19] addressed the importance of practical teaching through eliminating some verification experiments and adding comprehensive experimental projects to cultivate students' practical skills.

Yu Hualong et al. [20] believed that the experimental section of the course requires the setting of experimental topics to take into account both the uniqueness of each course and the relevance of the courses. Zeng Xianhua et al. [21] attempted to increase the practical teaching through combining classroom competition and science-education interaction in teaching. Jiang Qingyun et al. [22] considered signal and information processing as a partial technology course, which requires teachers to build a virtual platform for students' practical training operations according to the content of the textbook.

Diversified and Comprehensive Teaching Methods. Aiming at improving the teaching effects, comprehensive methods and techniques have been explored. For instance, Chen Hongyan et al. [23] guided the students to use school information resources for independent learning through "heuristics" and "discussion" teaching methods. Xu Xiaofei et al. [24] made full use of animation, actual system demonstration and electronic circuit system simulation software to allocate the task and estimate final effect of the experimental project. Zhou Dan et al. [25] introduced modern information technology on the base of traditional teaching methods. Chaoming et al. [17] adopted the teaching mode of combining teaching content with computer experiments, combining theoretical teaching with practical operation, and combining practical content with the cultivation of innovative ability to stimulate students' learning interest and innovative thinking ability. Luo Lan Wu et al. [26] proposed engineering education professional certification concept focuses on students 'ability to solve complex engineering problems. It is necessary to change the current teaching method that emphasizes "teaching" rather than "learning" to prevent students from being limited to mastering the content of the textbook and ignoring the generation of ability. Yang Jibin et al. [27] set up several seminar sessions to encourage students to think actively and participate in technical practice. Wang Li et al. [28] believed that the combination of textbook and MATLAB software can improve students' understanding of basic concepts by understanding the knowledge points in a simple and intuitive way. All these attempts indicate that more comprehensive and diversified teaching methods are applied in related courses.

Integrating the Latest Research Findings into Teaching. While exploring the best teaching method, some emphasis has been paid on how to integrate the latest research findings in teaching. Nan Jiangping et al. [29] focused on carrying out the research teaching concept all the way, explaining the scientific research content and the latest scientific research results which are closely related to the curriculum. Li Yang et al. [30] also adopt a multidisciplinary cross-integration approach, trying to introduce international cutting-edge scientific research results into the teaching practice of intelligent information processing.

Other than the improvement of the above-mentioned teaching methods, efforts in improving the quality of teaching team [9, 12] and improving teaching conditions and resources [23, 31] have also been made.

4 Reform of Course Assessment Method

With the development of intelligent transportation, not only the teaching content and the teaching methods for "Traffic Information and Processing" course should be reformed,

the assessment and evaluation method for students who receive such courses should also be updated. As to this aspect, some attempts have been made. Li Yang et al. [30] take into account the characteristics of the course of intelligent information processing and postgraduate training objectives, and adopt a more flexible assessment. Students final grade is determined by evaluating students' usual performance, including class attendance, class performance, and PPT report at the end of the semester, etc. Xu Jie et al. [16] introduced a process-oriented assessment model, which includes the assessment process throughout the whole learning process, focusing on the assessment of students' learning status, internship and experiment sections, adjusting the weight of course assignments, midterm examinations, midterm examinations and other assessment links while weakening the count for the final assessment. Guo Lin et al. [32] also addressed process-oriented concept and the proportion of process assessment scores in the evaluation mechanism of the course.

As can be summarized in these studies, a clear trend for the reform of assessment method is to emphasis the importance of process-oriented assessment other than only consider final exams. Such evaluation method pays more attention to the improvement of students' practical operation skills and application ability while solving traffic safety or efficiency problems, which is better aligned with the goal of cultivating comprehensive talents in ITS.

5 Conclusion

"Traffic Information Detection and Processing" is a professional core course for students in transportation majors, and appropriate teaching mode is critical for achieving good teaching effect so that the students' ability for information detection and processing can be improved. Through a comprehensive analysis of teaching reform methods in existing studies about information detection and processing related courses, the present work summarized the trend and possibility of teaching reform method of "Traffic Information Detection and Processing" course in terms of teaching content, teaching methods as well as course assessment methods. As can be concluded from the investigation, the major concentration for teaching content reform of this course is to enrich the teaching samples based on practical projects. While for teaching method reform, the proportion of practical teaching is emphasized and diversified teaching methods are adopted to improve the teaching effect. Moreover, the importance of integrating the latest research findings into teaching is also addressed. At last, the proportion of process-oriented assessment method is encouraged regarding the reform of assessment method.

These findings make it clear that the major direction of teaching reform for "Traffic Information Detection and Processing" is to increase the proportion of practical teaching and combine the latest research findings into teaching using diversified teaching methods. It can also be concluded that construction of modular teaching samples, project-based teaching and process-oriented assessment could be effective ways of improving the teaching effect. These conclusions are of great importance for cultivating professional application-oriented talents in the era of intelligent transportation.

Funding. This paper is supported in a comprehensive way by the following projects: 1) Reform of the Practical Teaching Mode of the Course "Traffic Information Detection and Processing" for

Transportation Major (Teaching Reform Project of Shenzhen Technology University in 2022 under Grant No. 20221015); 2) The 2nd Batch of 2021 MOE of PRC Industry-University Collaborative Education Program (Program No. 202107LH06 Kingfar-CES "Human Factors and Ergonomics" Program). 3) Exploration and Practice of Professional Course Group Construction in Applied Undergraduate Universities (Teaching Reform Project of Shenzhen Technology University in 2022 under Grant No. 20221017).

References

1. Rahmani, M. and Koutsopoulos, H.N. Path inference from sparse floating car data for urban networks[J]. Transportation Research Part C: Emerging Technologies, 2013, 30: 41–54.
2. Seo, T., Kusakabe, T. and Asakura, Y. Estimation of flow and density using probe vehicles with spacing measurement equipment[J]. Transportation Research Part C: Emerging Technologies, 2015, 53: 134–150.
3. Rui Xu. Discussion on the teaching reform of the course "Intelligent Transportation Information System" [J]. Curriculum Education Research, 2018, 52: 244.
4. Weihua Zhao. Research on some project-based teaching practice of transportation safety management course [J].
5. University of Hertfordshire. Transport Data; Collection and Analysis, https://www.herts.ac.uk/courses/short/transport-data-collection-and-analysis.
6. KTH VETENSKAP OCH KONST. AH2170 Transport Data collection and Analysis. https://www.kth.se/student/kurser/kurs/AH2170?l=en.
7. Southwest Jiaotong University. Road Traffic Information Detection Technology. http://online.pzhu.cn/meol/jpk/course/layout/newpage/index.jsp?courseId=43997.
8. Chang'an University. Modern Road Traffic Testing Technology. http://202.117.64.98/ec/C51/kcms/index2.asp.
9. Shi Chaoyi, Gao Xianhe, Zhang Sheng. Reform of Practical Course in Application-oriented Majors from the Perspective of Emerging Engineering Education--A Case Study of Signal Detection Technology[J]. Journal of Changchun University, 2022, 32(2).
10. Han Fang. The practical teaching reform of the course of sensor and detection technology from the perspective of information chain[J]. Journal of BeiBu Gulf University, 2020, 35(10).
11. Zhu Weixia. A Case Study of Object Detection Based on Python Deep Learning --A Case Study of Artificial Intelligence for School based Information Technology Curriculum in High School[J]. Modern Information Technology, 2022, 4(14).
12. Xiu Junshan, Wei Gongxiang. Research on the reform of photoelectric detection course integrating innovation and entrepreneurship education[J]. Education Forum, 2018, (10).
13. Jiang Wen, Deng Xinyang, Geng Jie. Exploration on the Course Construction of "Intelligent Information Processing and Fusion Technology" for Postgraduates under the Background of "Double first-class"[J]. Heilongjiang Education (Theory & Practice), 2022, (11).
14. Zhang Mei, Luo Guilan, Kui Liping, Feng Libo. Discussion on the Reform and Construction of the Curriculum Group of "Information Processing and Communication Theory"[J]. Journal of Higher Education, 2019, (2).
15. Wu Di, Sheng Long, Gao Yanfang. Exploration on case teaching of "intelligent information processing technology"[J]. Education Forum, 2017, (32).
16. Xu Jie, Qi Guangyun, Li Hanping, Fu Shuang, Meng Yanjun. The practical research on modular teaching of information processing courses[J]. Journal of Science and Education, 2022, (14).
17. Luo Chaoming, Tao Yangwei, Hu Shunchao, Li Wen. Research on the Construction of Signal and Information Processing Curriculum Group Based on the Training of Applied Talents[J]. China Electric Power Education, 2013, (291).

18. Huang Gang, Yang Yao. Research on the application of narrative education in practical teaching of "traffic information detection and application"[J]. science and Education Forum, 2022.
19. Xu Lichao. Teaching Reform and Practice of Automobile Testing Technology[J]. Equipment Manufacturing Technology, 2007, (10).
20. Yu Hualong, Zuo Xin, Gao Shang, Qin Bin. Research on the Teaching Reform Mode of "Intelligent Information Processing" Course Group[J]. Education Teaching Forum, 2016, (15).
21. Zeng Xianhua, Li Weisheng, Yu Hong. Teaching reform of machine learning course under intelligent information processing course group[J]. Computer Education, 2014, (19).
22. Jiang Qinyun. On teaching methods of signal and information processing[J]. Information Communications, 2012, (6).
23. Chen Hongyan. Integration of Information Technology and the Course of "Sensor and Automatic Detection Technology"[J]. THE WORLD&CHONGQING, 2011, 28(2).
24. Xu Xiaofei, Li Denghua, Li Juan. Design and Implementation of Practical Teaching for the Course of Intelligent Sensing and Detection Technology[J]. Computer Education, 2013, (19).
25. Zhou Dan. Effective integration of modern information technology and traditional teaching methods in the teaching of "Sensor and Detection Technology"[J]. China Electric Power Education, 2012, (21).
26. Lan Wu, Xueying Jia, Jie Jiang, Yarong Chen. Research on Curriculum Reform of Sensor Technology and Application under Engineering Education Professional Certification. Atlantis Press. 2022(650)
27. Jibin Yang, Tieyong Cao, Fei Zhao. Teaching Signal and Information Processing Classes from a Total Information Perspective. Journal of EEE. 2019, 41(1)
28. Li Wang, Wei Wang, Yangmei Zhang. Construction of Signal and Information Processing Course Cluster in the Context of New Engineering. Journal of Higher Education. 2021(8)
29. Nan Jiangping, Zheng Kai, Wang Juanjuan. Research on the Reform of Sensors and Automatic Detection Technology Courses based on IOT Environment[J]. Proceedings of the 1st International Symposium on Innovation and Education, Law and Social Sciences. 2019
30. Li Yang, Luo Meilin. New thinking on the teaching model of interdisciplinary intelligent information processing graduate courses[J]. Computer Education, 2016, (10).
31. Ren Wei. Research on the theory and practice of the integration of modern information technology and "sensor and detection technology"[J]. Netfriends, 2013.
32. Lin Guo, Weiming Yang. Construction of Signal and Information Processing Course Cluster System under the New Engineering and Engineering Education Professional Accreditation. Changjiang Information & Communications. 2022(3).