Exploration and Practice of Mixed Teaching Mode of “Agricultural Mechanization” Professional Courses under the Perspective of China’s “New Engineering + First-class Course”—Take Northeast Agricultural University “Agricultural Mechanics” Course as an Example

Wenqi Zhou, Xiaobo Sun, Nuan Wen, Kai Song, Jinwu Wang*

School of Engineering, Northeast Agricultural University, Harbin, Heilongjiang Province, China.

How to cite this paper: Wenqi Zhou, Xiaobo Sun, Nuan Wen, Kai Song, Jinwu Wang. (2023). Exploration and Practice of Mixed Teaching Mode of “Agricultural Mechanization” Professional Courses under the Perspective of China’s “New Engineering + First-class Course”—Take Northeast Agricultural University “Agricultural Mechanics” Course as an Example. The Educational Review, USA, 7(2), 131-136. DOI: 10.26855/er.2023.02.003

Received: December 27, 2022
Accepted: January 21, 2023
Published: February 24, 2023

Corresponding author: Jinwu Wang, School of Engineering, Northeast Agricultural University, Harbin, Heilongjiang Province, China.

Abstract

With the construction and implementation of "new engineering" in China, the construction and improvement of first-class course are closely followed, and in order to meet the new requirements of talent training in new industries, the construction standards of "first-class course" are followed. In view of the outstanding problems such as insufficient teaching content, single model and poor learning quality of students in the courses of agricultural mechanization and automation in China, a new engineering education concept of "student-oriented" and "learning-result-oriented" is put forward, and an "Internet +" network platform of key links of intelligent agricultural machinery equipment and cutting-edge technology content is built. The mixed teaching mode of "MOOC learning + flipped teaching in class + exercise consolidation after class + multiple evaluation" is created before class, which conforms to the training goal of compound outstanding engineering talents, providing practical experience for the curriculum construction of new engineering majors in China.

Keywords

Agricultural machinery, new concept of engineering education, mixed teaching mode

1. Introduction

In February 2017, the Ministry of Education of China held a seminar on the development strategy of higher engineering education and the construction of new engineering, forming the "Fudan Consensus" (Yu Jianxing, Ji Ying, Yu Yang, Yu Hong, & Duan Qinghao, 2020), "Tianda Action" (Lin Jian, 2017) and "Beijing Guideline" (Wu Yan, 2018), which set off a wave of reform for the construction of new engineering in China's higher engineering education. In October 2019, the Ministry of Education of China issued the Implementation Opinions of the Ministry of Education on the Construction of First-class Undergraduate Courses (Jiaogao [2019] No.8) (The Ministry of Education, 2019), which proposed the construction of first-class undergraduate courses that meet the requirements of the new era of China. This
teaching team explores, constructs and summarizes mixed teaching mode from the perspective of "new engineering + first-class course" construction in China, providing practical experience for the construction of similar courses.

2. The orientation and challenge of agricultural machinery professional courses

2.1. Course orientation

"Agricultural Machinery" is a compulsory course for agricultural mechanization and automation major of Northeast Agricultural University of China, with a total of 3 credits and 48 credit hours. It starts in the autumn semester of junior year. As an important core course of the major, the teaching content includes basic theoretical knowledge of agricultural machinery, mechanical structure and operation skills, as well as new technology of agricultural machinery and the development trend of agricultural machinery in the future.

2.2. Course challenges

With the implementation of China's modern agriculture and rural revitalization strategy, based on the development of new industries, more and more emerging technologies, such as artificial intelligence, Internet + and blockchain technology, have gradually integrated into agricultural mechanical courses, and the traditional curriculum system knowledge is gradually unable to meet its knowledge boundary. At the same time, the traditional one-way indoctrination teaching mode can not stimulate students' interest in learning, resulting in the loss of students' main role and deviating from the teaching concept.

Fu Wei et al. (2017) integrated competition into the curriculum reform of "Agricultural machinery" through the educational mode of "promoting learning by competition, promoting competition by learning and combining competition with teaching", thus improving the teaching quality. Lu Qi et al. (2021) reformed the practical teaching links of professional courses through the co-working mode of Party committee and administrative department, so as to improve the ability of practical education and the level of practical teaching. Ruan Peiyi et al. (2021) built a consistent education system of "theoretical learning-practical exercise-competitive verification" of "agricultural machinery" based on the development background of agricultural machinery towards informatization and intelligence. Based on the concept of OBE, You Jia et al. (2021) introduced engineering cases into the classroom to ensure the quality of course teaching, guided by the needs of enterprises and aiming at solving students' problems and cultivating comprehensive quality and ability.

Many scholars have carried out research on the teaching mode of "agricultural machinery" through the methods of "integration of competition and teaching", "joint of Party committee and administrative department" and "task-driven". Although the learning quality of students has been significantly improved, the teaching quality of courses has not been fully improved from the perspective of "new engineering + first-class course" in China. As a result, the teaching content is not advanced, the teaching model is single, and the students' learning quality is poor. Therefore, the MOOC+SPOC network information platform is constructed through innovation in the process of education theory, education content, education model, teaching assessment and teaching feedback research. So as to achieve online resources - offline activities - tasks before class - projects in class - practice after class - teachers and students have cooperation - platform monitoring - evaluation - real-time communication of professional courses teaching mode.

3. Exploration of the teaching mode of "agricultural mechanization" course under the perspective of "new engineering + first-class course" in China

3.1. Requirements for the construction of the curriculum system of agricultural engineering major under the background of "new Engineering" in China

1) The social and industry development status of talent training

In China's socialist modernization, agricultural modernization is the foundation and the promotion of rural agricultural modernization is the key (Xue Jinlin, Dai Qinghua, & Yao Xuexia, 2019; Wu Aihua, Hou Yongfeng, Yang Qiubo, & Hao Jie, 2017). At present, China's crop mechanization level has exceeded 70%, but there is still a certain gap with developed countries. As intelligent agriculture, agricultural robots, biological sensing, Internet of things and other agricultural engineering research frontier and hot spots, it is urgent to explore the intelligent agriculture, green agriculture, ecological agriculture and other new agricultural development models.

2) Agricultural talent training target positioning

As a major for agricultural and rural development to train various agricultural engineering industry talents, the current situation of national agricultural engineering development should also be fully considered when setting profession-
al training goals. Therefore, in the current cultivation of agricultural engineering professionals, on the one hand, it is necessary to equip the cultivated personnel with the professional knowledge and skills required by traditional agricultural engineering; on the other hand, it is necessary to grasp the development frontier and promote the transformation and upgrading of production and life style in China's agricultural field in a larger scope. It is necessary to strive to improve the development level of agricultural engineering, and it is in urgent need of new agricultural engineering talents with high humanistic literacy, information literacy, scientific literacy and extensive professional knowledge for the present and future.

3) The frontier content of agricultural machinery development is incorporated into the whole course teaching process.

Classroom teaching is not only a simple one-way indoctrination, but also the extension and expansion of this knowledge, the combination of theoretical knowledge and production practice. Teachers should actively pay attention to the frontier of agricultural machinery engineering discipline and industry development, do a good job of knowledge internalization, and improve the connotation and quality of classroom teaching. The frontier dynamics of agricultural engineering major are timely integrated into its own classroom teaching process, inspire the students to think, update the course content, and make the students' knowledge system more suitable for the social development needs of the most effective method.

3.2. Construct advanced teaching theory

In recent years, the construction and reform of China's new curriculum system requires teachers to constantly learn advanced teaching theories, build a student-oriented teaching model and discard old teaching concepts. In the teaching process of agricultural machinery, the construction of advanced teaching theory is an important guarantee to effectively promote students to master the relevant skills and knowledge. In traditional education, teachers play an active role in teaching knowledge, while students only play a passive role in accepting knowledge. This monotonous teaching mode is easy to make students feel bored, leading to that students cannot master knowledge well. However, in the modern teaching concept of China, more emphasis is placed on the development of students' learning initiative and enthusiasm, which is always student-centered. Teachers only play the role of guide, helper, organizer and facilitator in the teaching process. Meanwhile, online education platforms are used to create teacher-student interaction situations and rebuild students' traditional learning process. In this way, the students will think that what they have learned is not passively received, but reconstructed through their own efforts and with the appropriate help of the teacher. In this way, the initiative of the class will be transferred from the teacher to the students, and the students will grasp the knowledge more firmly. In order to achieve the common progress of teachers and students.

4. Exploration of mixed teaching mode based on agricultural mechanics courses

4.1. Reconstruction of mixed course teaching objectives

The essence of the mixed teaching mode is to refine the relationship between knowledge system and learning system. It is a kind of teaching mode based on students' independent self-study, supplemented by teacher guidance, and realizes the mixture of online and offline (Wang Zeyan & Yao Jia, 2017). In the mixed teaching link, a three-stage learning loop before, in and after class can be formed through the class. Before class, explain the classroom professional knowledge through online teaching platform resources, so that students can preview the classroom knowledge points in advance and grasp the knowledge system needed to be constructed. In class, demonstration, group teaching, class discussion and other teaching forms are used to evaluate pre-class learning, group discussion of common problems, teacher evaluation of students' completion, and unified description of common problems. After class explain to strengthen the knowledge point, complete the online test. Refine the knowledge points of the course and publish the learning tasks to the platform as course tasks. The actual competition items are introduced, and the project is decomposed into stage tasks. Through reasonable grouping, the project tasks are completed in stages, and the effect evaluation is carried out. An important teaching goal of agricultural machinery course is that students can understand the history, current situation and prospect of agricultural mechanization development in various countries, as well as the frontier technology of agricultural machinery industry, and have the ability to design and improve advanced intelligent agricultural machinery. Therefore, it is the ultimate embodiment of mixed teaching objectives of agricultural machinery to create high-quality gold courses for agricultural machinery, cater to the development of new industries such as intelligent agricultural equipment and intelligent agriculture, and optimize the teaching mode of agricultural mechanization and automation courses.

4.2. Implementation of the mixed teaching process

Teachers are the integrators and designers of course resources. Through the self-built MOOCs of "Agricultural ma-
chinery” on the China Wisdom Tree platform, complete teaching videos, online exercises, teaching courseware, teaching syllabus and other resources are provided through the platform, providing excellent teaching resources and teaching guarantee for online teaching methods. Before class, the teacher asked the students in the class to form a team by themselves, which was composed of 5-6 members. The students who did not form a team were grouped by the group teaching module in the Zhidao software. At the same time, the teacher imported the groups formed by themselves into the group teaching module in the Zhidao software, and then randomly appointed a student in each group as the leader and released the list of learning tasks. The main content is to design the cutting-edge agricultural machinery and equipment under any agricultural production link, the project design reflects the pioneering and innovative. Students preview the video in advance according to the task list, and master the core knowledge points by consulting literature and professional books. Teachers answer questions online according to students' questions. Finally, students completed the project design of cutting-edge agricultural machinery through group discussion and collaboration. Meeting class is an important part of blended teaching mode. Through flipped teaching mode, it can improve students' class participation and test students' learning effect. In order to urge students to work together to complete pre-class tasks, avoid the problem that individual students do not participate, and realize the full coverage of the learning network. First of all, in the course of teaching, the teacher randomly selected any member of the group to explain in class, and defended the design ideas, complete machine structure, working principle, mind map and other contents of the frontier agricultural machinery. Other members of the defense group supplemented the missing knowledge. Then, the non-defense group members questioned the feasibility and innovation of the design scheme based on the explanation content, and the defense personnel answered the questions. Finally, the teacher made comments and process evaluation according to the defense situation and design content of each group. Homework is an effective means to test the learning effect, and it is a necessary process to consolidate and absorb new knowledge and realize knowledge digestion. In addition to the teaching practice activities in class, students will be tested online objective and subjective questions on the MOOC platform after class. The exercises are designed according to the teaching objectives, and diversified forms of homework are adopted to focus on students' ability to master the application and ability of designing cutting-edge agricultural machinery equipment, which is highly targeted and representative. The exercises include multiple choice questions and discussion questions for the design of cutting-edge agricultural machinery equipment, which are finally submitted to the website platform.

4.3. Setting of mixed teaching evaluation and assessment mode

Based on the data quantification of the "Internet +" platform, combined with the interactive scoring of offline courses, a more rapid, convenient and accurate assessment system for professional courses is formed, thus changing the disadvantages of the previous assessment system being single and presenting diversified assessment methods. Through the data storage of the whole teaching cycle provided by the "Internet +" platform, students' completion of preview, interaction, discussion and collaboration can be comprehensively quantified, which is convenient for teachers to analyze course data from multiple levels, scientifically cover every teaching link, realize the whole dynamic tracking and feedback, and accurately adjust the teaching mode. The main content of agricultural machinery course assessment includes: learning process evaluation (10%) + team cooperation evaluation (30%) + final examination evaluation (60%). Learning process evaluation includes attendance (3%) + class participation (3%) + in-class question-and-answer (2%) + homework exercises (2%). Teamwork evaluation includes teacher evaluation (50%) and inter-group evaluation (50%). The final exam will include fill-in-the-blank, noun interpretation, calculation and short answer (50%). All interactive links and questions involve the design and ideological content of cutting-edge agricultural machinery equipment. The combination of online and offline evaluation and assessment is adopted to improve students' autonomy, process and experiential learning effectiveness, which not only arouses students' enthusiasm for learning, but also deepens their understanding of the course content.

5. Feedback of mixed teaching mode

Teaching feedback is an important guarantee to continuously improve the quality of courses, obtain higher teaching results and continue students' learning enthusiasm (Guo Zhongqing & Gao Congcong, 2020). In order to obtain teaching feedback information in time, research on teaching feedback is carried out from two aspects: According to students' class participation, homework completion and final assessment score, teachers themselves capture students' performance in various aspects, dig out the deficiencies in the learning process of students, think about how to adjust the teaching plan to make up for the deficiencies of students, observe whether the teaching model meets the standards according to the overall level of students' assessment, and then find out the inappropriate teaching, and analyze the solution, adjust and improve the teaching details.
Timely feedback is the most effective form of after-class consolidation, teachers should often communicate with students. In the teaching process, it is necessary to ask the students' feelings after each class, investigate the students' recognition and satisfaction of the teaching effect, and understand the doubts of students. When students have common problems with the teaching mode, teachers should solve them in time, understand the ideas and feelings of students, and think about how to have a positive impact on students in the teaching process from the perspective of students. When a small number of students cannot adapt to the teaching mode, encourage and guide students to liberate from the deviation and wrong thoughts, give students confidence, mobilize their enthusiasm, and let the advantages of the new teaching mode radiate to every student.

6. Conclusion

The teaching reform of China's new engineering construction is bound to closely focus on professional talent training objectives and graduation requirements, based on this, combined with the development of smart agricultural industry and the strategic needs of China's rural revitalization strategy, the teaching team carried out the mode reform and content reconstruction of traditional teaching with integrating modern education and teaching concepts.

1. In teaching theory, old teaching concepts are abandoned and new teaching theories that keep up with The Times are cultivated. Teachers no longer blindly tell knowledge to students, but play a role of guidance and assistance, and students become the main body of teaching. With the help of the network teaching platform, students can experience the fun of developing their own knowledge system, stimulate students' learning enthusiasm, and achieve the purpose of making students really fall in love with learning.

2. In terms of teaching content, cutting-edge technologies of agricultural equipment are integrated, including precision fertilization technology, targeted spraying technology, intelligent grain harvester, unmanned operation technology, etc. By searching online videos, scientific research literature and other paths, knowledge units of intelligent agricultural machines and tools are built on MOOC platform to improve the innovation and challenge of teaching content.

3. In terms of teaching mode, through the form of "online self-study + offline flipped classroom", modern information teaching means are used to improve students' autonomous learning ability and innovative design ability to achieve the organic integration of value leading, ability cultivation and knowledge imparts.

4. In terms of assessment and evaluation, it attaches importance to diversification and process evaluation, and "learning process evaluation + team cooperation evaluation + multi-dimensional evaluation method of final examination evaluation" is set to reflect the effect of students' independent learning and their comprehensive ability to solve problems.

5. In terms of teaching feedback, more attention is paid to timely feedback, and constantly modify and improve the teaching model according to self-feedback and student feedback, so as to maximize students' learning enthusiasm and improve classroom efficiency, so as to obtain better teaching results.

Acknowledgements

This work is supported by New Engineering Research and Practice Project of Ministry of Education of China "Exploration and Practice of Agricultural Mechanization and Its Automation Professional Transformation and Upgrading" (E-JX20201512), Research on the ideological and political construction and practice of "agricultural mechanization" courses under the background of China's first-class undergraduate majors (GJB1423434), & Northeast Agricultural University of China "Curriculum Ideology and Politics" pilot course construction project.

References


