

Application of Flipped Classroom Model in The Integrated Course of Theory & Practice ——An Example of Automobile Maintenance Course in Vocational Colleges

Jianmei Mao^{1,*} and Ying Li²

¹ No.967, Anning West Road, Education School, Northwest Normal University, Lanzhou, China

² Lanzhou Petrochemical Polytechnic, Lanzhou, China

*Corresponding author. Email: 946961569@qq.com

ABSTRACT

Flipped classroom is an effective teaching model. The application of integrated courses of theory and practice in vocational colleges not only innovates educational forms, enriches teaching resources, but also helps cultivate students' practical ability. Taking the automobile maintenance course as an example, modularization of the integrated course of theory and practice is classified, application paradigm of the flipped classroom in the integrated courses of theory and practice is designed in the process of the course of implementation, which is conducive to improving students' problem-solving ability and promoting the comprehensive ability of "Double-qualified" teachers.

Keywords: *Flipped classroom mode, Integrated course of Theory & Practice, Vocational colleges.*

1. INTRODUCTION

The "Chinese National Vocational Education Reform Implementation Plan" clearly states that teachers should do modularized teaching by division of work and collaboration, strengthen the integration of knowledge and practice, and combine theory with practice, focus on cultivating high-quality workers and technical skills, and accelerate development of a modern vocational education system. The aim to continuously propel of the reform of teaching methods, a more efficient, reasonable and innovative integrated teaching model of theory & practice will replace the traditional teaching model "The integrated teaching of theory & practice is an innovative model explored in professional teaching in vocational colleges." [1] It is integration of theoretical teaching and practical teaching, realizing integration of knowledge and action, and combined use of hands and brains. However, based on investigations, it is found that the current integrated teaching of theory & practice in vocational colleges has problems such as insufficient application of information technology, and weak teaching ability as "double-qualified" teachers (teachers with both theoretical and practical teaching capabilities).

The "flipped classroom" originated from the "Woodland Park" high school in the Rocky Mountains of Colorado, USA. The practice of Khan Academy has quickly become a hot spot for educators. [2] In the flipped classroom, the role of the teacher has changed from the knowledge imparter in the traditional classroom to the reformer and instructor of learning; time and space are redistributed, teachers can save more time for students' learning activities. Besides, students' personalized learning happens in support of technology, and students change from passive receivers to active learners, which exert better educational effects. The year of 2014 is the first year when MOOC was widely used in country, after continuous attempts by educators, it has developed rapidly in elementary and middle school education, but this teaching model is rarely used in the integrated courses of theory and practice in vocational colleges. Therefore, there is still a lot of room and depth to explore the application of the flipped classroom teaching model in various disciplines of vocational colleges.

2. APPLICATION OF FLIPPED CLASSROOM IN THE INTEGRATED COURSE OF THEORY & PRACTICE

2.1. Design of the Integrated Course of Theory & Practice

The teaching design of the flipped classroom in the integrated course of theory and practice of “Car Maintenance”, According to basic skills training, special ability training, technical application ability training, three-level training projects are set up to cultivate students’ comprehensive application ability, innovation ability and the ability to solve key technical problems. The two teaching levels such as theory & practice teaching are fully combined, and work and study are alternated, so that practice teaching and theory teaching form a whole unity. The design ideas of this course are as follows: First, through classroom observations, understand present situation of integrated teaching of theory & practice in vocational colleges, and find out the problems in application of the traditional integrated course of theory & practice in vocational colleges through teacher interviews and student interviews. The aim to use the flipped classroom teaching model is to solve the problems in practice. Secondly, in view of the disconnection between theoretical and practical teaching and weakness of practical teaching in the current vocational colleges, combined with the specific situation of integrated courses, the essay takes professional course of automobile inspection and maintenance technology as an example, carry out the teaching design of flipped classroom. Thirdly, the following factors are fully considered in course design such as characteristics of male-oriented students majoring in automobile inspection and maintenance, weak academic foundation, and strong hands-on ability [3]. In the design of course content and teaching, theoretical learning is mainly carried out before class, principles of car maintenance are clearly demonstrated through animation and video, and practical operation should be from easy to difficult, combine teachers’ practical demonstration in class with guiding students to practice. Finally, as a teacher of an integrated course of theory & practice, he must be a “double-qualified” teacher with both strong theoretical knowledge and practical ability, not only to master the structure and principles of automobiles, but also to have more professional experience and practical ability in troubleshooting.

2.2. Implementation of the Integrated Course of Theory & Practice

2.2.1. Online & Onsite Teaching Mode Adopted in the Theory Classes before the Flipping

The ‘Internet +’ model can truly break boundaries of time and space for traditional education and school walls, and expand the channels of knowledge acquisition in a multi-dimensional manner. Teachers are no longer the only source of knowledge, and teaching materials are no longer the only carrier of curriculum resources. Learning resources for students can be obtained by themselves according to individual needs. [4] But it poses greater challenges for the traditional teaching, so teachers should mainly adopt a mixed teaching model according to the characteristics of learners. In order to ensure the effective implementation course, first of all, clarify the teaching goals. Teachers should clarify the teaching goals before each class so that students know what they want to know, understand, and master. Secondly, online teaching implementation plan is formulated in accordance with the actual situation, teaching platform is carefully selected through multiple channels, such as online good-quality courses and live class, MOOC platform, etc. The online platform of famous teachers and experts provide learners with a broader vision and rich resources. Furthermore, teachers adopt hybrid teaching models that combines online resource and onsite one to help students master theories and acquire technical skills by teachers’ guidance and students’ exercises. After class, teachers need to feedback to students if each class’s teaching goals are achieved, and design homework and test questions based on what they have learned to ensure the learning effect.

2.2.2. Modular Teaching Adopted in the Integrated Course of Theory & Practice after the Flipping

2.2.2.1. Goal Setting

The aim is to strive to cultivate creative technical talents with strong hands-on ability and matching job competence standards of automobile maintenance personnel based on solving automobile problems. The establishment of the teaching objectives for the integrated course of automobile maintenance and theory is mainly based on the job requirements of the maintenance workers in the automobile maintenance industry, while job requires the maintenance workers to master the maintenance and debugging methods of the automobile engine and chassis assemblies. Knowledge objectives: to enable students to familiarize with names, functions, and mutual assembly relationships of automobile engines, automobile chassis, and automobile

electrical equipment through automobile maintenance courses, and to further understand their working principles. Occupational skills objectives: to master usage of various maintenance tools and machinery, and be familiar with the role of various automobile assemblies, systems and main components, Structure and mutual assembly relationship, master the basic maintenance and adjustment methods of each assembly, and be able to complete tasks. Besides, obtain the vocational skill certificate of the vehicle maintenance intermediate worker. Professional quality development goals: to cultivate serious, meticulous, and strict work style, abide by safe operating procedures, perform safe operations, abide by technical operating procedures and standard operation.

2.2.2.2. Setting Modules

In accordance with the requirements of high-skilled personnel training in vocational colleges, actively cooperate with industry enterprises to develop teaching content based on the work process of enterprises. According to the auto maintenance professional qualification standards and the needs of the company's position, curriculum system and teaching content should be reformed. Namely, establish an action system curriculum and curriculum standards that highlight professional ability and quality training integrating professional ethics with advanced corporate culture. In addition, teaching process should focus on process-oriented, task-oriented and project-based task. One is to adopt task-oriented teaching method, namely, each task is given clear teaching goals and tasks, allowing students to complete practical teaching with tasks, increasing students' initiative and interest in learning, and obtaining better teaching results. The second is to adhere to the guiding ideology of "students as owner, teachers as leading role, and ability as key aim". Under the guidance of teachers, students can fully develop their own learning ability, professional adaptability, problem-solving ability, and career Innovation capacity. First of all, through the analysis of the needs, job description, ability description and professional core technology of the auto maintenance industry, professional courses are integrated according

to daily tasks of auto maintenance post, which are integrated into eight task modules, as Figure 1 shows:

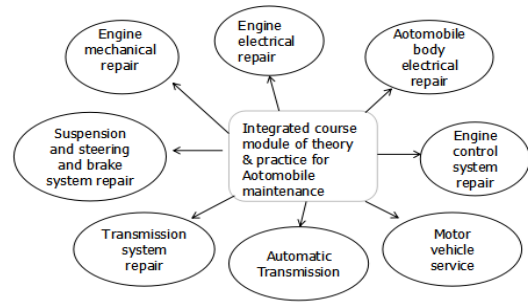


Figure 1 Automobile maintenance course modules.

2.2.2.3. Teaching Implementation

Teaching items in each task module stems from the real maintenance tasks of the automobile maintenance post, and teaching items include professional knowledge and vocational skills required to complete the maintenance tasks. In order to complete teaching project, the flipped classroom teaching mode is adopted to design automobile maintenance integrated course of, theory & practice, and introduce theoretical and technical knowledge in practical operations. Table 1 shows that we will take learning car engines as an example. First, let the students go to the car repair shop to learn about the engine. Next, teacher needs to show the actual engine, explain the working principle and structure, and then let the students try to tell the problems caused by the engine. The teacher can analyze the causes and propose solutions by some cases of engine malfunction, the aims of course design are to allow students to find other problems caused by engine malfunction, deepen students' understanding of the working principle of the engine, and how to troubleshoot problems. During the class, students are divided into many groups to demonstrate on-site operations, consolidate the operating procedures and essentials, and enhance the students' practical ability. After class, students are guided to reflect and summarize main points in order to solve complex problems arising in complex situations.

Table 1. Implementation of the flipped classroom for car engines

Mode	Subjects	Before Class	During Class		After Class
Online	Teacher	Learning objectives and requirements: Engine principles and troubleshooting; explain car engines working principles	Explain the cases	Show cases of engine malfunction	Record the troubleshooting video
	Student	Collect materials such as excellent video lessons about car engines	A learning method centered on problem solving	Try to answer the problems caused by engine malfunction	Watch the video repeatedly, summarize the operation essentials
Onsite	Teacher	Explain principles and structure of the car engines through physical display, emphasizing important points	Situational teaching, on-site guidance	Demonstrate the malfunctions, and explain reasons	FAQ, and demonstrate the important points
	Student	Know the car engines, and understand each components and functions	Cooperative learning, problem-solving, classroom discussion	Try to solve other problems caused by the malfunctions	Repeatedly practice on site, summarize and report

2.2.2.4. Teaching Evaluation

Evaluation of integrated course of theory & practice is based on process evaluation, summative evaluation as reference. Before flipping, online evaluation is based on whether students complete small sub-objectives or not and classroom interaction; identification of engine components and functional descriptions are regarded as onsite evaluation basis; online in-class question answering and exploration of difficult questions and development of divergent thinking are considered as evaluation standard; onsite evaluation is mainly based on classroom observation, problem assessment, and standardization and fluency of hands-on operation. After-class assessment is based on asking difficult questions and the breadth and depth of thought.

3. APPLICATION EFFECTIVENESS OF FLIPPED CLASSROOM IN THE INTEGRATED COURSES OF THEORY & PRACTICE

This study takes the effective application of the flipped classroom teaching model in automobile maintenance in vocational colleges as an example. Through comparative research, it is found that this model improves the classroom efficiency and is conducive to achieving the goal of talent training.

3.1. Application of Flipped Classroom is Conducive to Improving Students' Problem-solving Ability

In order to fully highlight the practicality and effectiveness of the training courses, and reflect the teaching philosophy of students as owners in class, this study designs three-dimensional curriculum objectives such as knowledge, skills and quality. In the research process, the connection of teaching steps and existing problems in the class were analyzed through the

methods of classroom observation and interview. Then integrated courses of theory & practice in ordinary class and tested class are compared, and traditional teaching mode and the flipped classroom teaching mode are compared in detail. Through the comparison, it is found that the flipped classroom teaching mode is beneficial to actively participate in classroom activities and cultivate students' observation ability and repeated practical trainings promote mastery of students' practical knowledge and improvement of their practical skills. In addition, in order to fully consider students' willing, a questionnaire survey was conducted among students. 87% of the students believe that the flipped classroom teaching model requires students to have strong capabilities to search for information and active learning. In the process of problem solving, it is necessary to rely on group cooperation and active class discussion and focus more attention on cultivation of students' inquiry and practical skills. Teachers need to record demonstration steps and methods by video, especially live demonstrations that prompt students to discover steps or problems they don't understand. After class, let students watch video and practice over and over again to improve students' practical ability, which cannot be achieved in traditional classrooms. According to Interviews with teachers, it is found that the model helps improving students' problem-solving ability and practical ability through the on-site practical operation and assessment.

3.2. Application of Flipped Classroom is Conducive to Improving the Comprehensive Ability of "Double-qualified" Teachers

To adapt to rapid development of information technology, teachers need to choose an appropriate teaching model for specific teaching requirements to improve classroom efficiency. For this reason, "Teachers should be familiar with and master a variety of teaching modes, and have sufficient psychological

preparation, and adjust the teaching mode flexibly based on teaching conditions.” [5] Therefore, before the reform of the integration of theory & practice, teachers need fully understand the connotation and characteristics of the flipped classroom teaching model, carefully design the classroom. One is to make preparations before class, such as collection of data, selection of online platforms and other details. When conducting onsite teaching in the training workshop, teacher should solve the online problems firstly, and explain key and difficult points in the theoretical knowledge by displaying actual objects and intuitive molds, so teachers should have a rich practical experience in car fault diagnosis and maintenance, and teachers should regularly go to cooperative company to participate in practical work, and gain more actual maintenance experience. The second is that teacher should play a full role as a guide and students as owner in class. To discover and solve problems in class, Students will become organizers of their own learning and explorers of problems, so that students’ application ability of analogy and inference are developed. Third, after class, teachers should explore the corresponding methods for the influencing factors, strategies and existing problems, reflect on how to optimize the application of flipped classrooms, and put forward reasonable suggestions. “Reflection is an important way for teachers to improve their teaching ability.”[6] Therefore, to cultivate high-quality technical talents, teachers need to place teaching in the context of class to think about its value and methods, which is conducive to not only improvement of “double-qualified” teachers but also cultivation of talents.

3.3. Teaching Design of Flipped Classroom can be Promoted as an Application Paradigm

In order to complete teaching design of the flipped classroom teaching mode, these factors should be considered such as tasks of teachers and students, teaching method, different teaching periods before, during and after class, before and after flipping, online and onsite class, combined with characteristics of automobile maintenance , including after-class exercises and other links. The teaching design provides ideas and references for the teaching of integrated courses in other different subjects. First of all, the model can improve classroom efficiency and maximize the advantages of on-site teaching resources and teachers. Effective teaching requires teachers to have “clear teaching lessons; flexible and diversified presentation of class content and effective learning materials, and other teaching elements; task or problem-oriented; guiding students to participate in the learning process.” [7] These are five key behaviors of effective teaching to promote teachers, are also the key elements that teachers should consider in implementation of the integrated course, and they are effective to improve classroom

efficiency. Secondly, the model requires active participation by students, which not only reduces teachers ‘burden to manage classroom , but also deepens understanding knowledge for students, such as whether key knowledge is mastered and whether practical ability is improved. What’s more, it is beneficial to use of teaching methods in accordance with their aptitude. Although different courses and different teachers have their own unique insights and experiences in applying teaching models, these experiences can still provide new perspectives and practical reference for other similar courses. Therefore, teachers need to continuously reflect on how to break through professional barriers, try new teaching models, and innovate application design their courses, so that application of teaching models can be perfected.

4. CONCLUSION

Practice has proved that flipped classroom mode has become an effective teaching mode to improve traditional theoretical classroom teaching, and application of flipped classroom in the integrated course of theory & practice in vocational colleges is a relatively novel exploration, which can promote reform of practical teaching mode, implementation of integrated course of theory & practice, and improve the ability of students to transform knowledge. Based on the subject simulation training platform, application of integrated practice teaching of theory and practice not only has innovated educational forms, enriched teaching resources, but also solved the problems encountered by students in the process of practice, and truly realized teaching aims of the integrated course of theory & practice.

ACKNOWLEDGMENTS

Project Fund: Gansu Province Educational Science "Thirteenth Five-Year Plan" Key Project in 2020: Research on effectiveness and training path of development of "double-qualified" teachers in the western region. (Project number: GS [2020] GHBZ207).

REFERENCES

- [1] Siwei Yan. Ability-based Teaching Research on the Integration of theory & practice in Vocational Colleges—Taking the Character Image Design Major of Sichuan XX Vocational School as an example [D], Sichuan Normal University, 2016.
- [2] Jinlei Zhang, Research on the Flipped Classroom Teaching Mode [J], Journal of Distance Education. 2012(4): 46-51.
- [3] Jianmei Mao. Investigation of the source of enrollment in vocational colleges and strategies and suggestions for teaching management-taking the

- 2019 freshmen of Lanzhou Petrochemical Polytechnic as an example [J]. Vocational Education, 2019(12): 74-80.
- [4] Jian Wang, Fuhai An, Zelin Li. The progress and reflection of curriculum and teaching theory research under the background of "Internet +"[J]. Educational Research, 2017(11): 105-114.
- [5] Zuozhang Duan. Curriculum Reform and Teaching Mode Transformation [J]. Educational Research, 2004(6): 67-71.
- [6] Yuhua Bu, Xiaojuan Yang: The Value Reassessment and Framework Reconstruction of Teaching Epistemology in my country [J]. Nanjing Social Sciences, 2019(8): 193-144.
- [7] [US] Gary D. Boric ,Translated by Dongping Yi. Effective teaching methods [M]. Jiangsu Education Publishing House. 2002 (12): 8-9.