

Study on the Flipped Classroom Teaching Mode of Middle-level Mechanical Courses based on Micro-course

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Abstract

Present, there are phenomena that teachers pay too much attention to the transmission of knowledge, students' motivation is not high and the assessment method is single in the teaching of middle-level mechanical courses. On the basis of the analysis of the teaching status of middle-level mechanical courses, the flipped classroom teaching mode of middle-level mechanical courses is explored from the aspects of micro-course design, teaching process design and teaching evaluation system design, which is important for the current teaching of middle-level mechanical courses. It has an important role in the teaching practice of middle-level mechanical courses.

Keywords

Middle-level Mechanical Courses; Flipped Classroom; Micro-Class; Teaching Mode.

1. Introduction

As modern information technology continues to develop deeply in the field of education, more and more people are paying attention to the importance of micro-lessons. Microlearning is a process of teaching in the form of a video, which focuses on teaching objectives and knowledge points, and aims to help students visualize their knowledge and understand it more clearly and systematically. The most important feature of micro-lessons is that they are "short", which can accurately capture students' attention in a short time and effectively improve learning efficiency. The second feature is "precision", micro-lessons have a strong focus, can focus on the key points and difficulties in accordance with the educational objectives, and explain efficiently and accurately. The third characteristic is "interesting", because of the strong theoretical nature of mechanical courses, students inevitably feel boring in the learning process, teachers can focus on the relevant knowledge, integrate their own teaching characteristics of the way of explanation, the use of pictures, music, animation and other forms to improve the autonomy of students learning.

However, as an informational teaching tool, microlearning needs to be applied in a teaching model that works with it. The microlearning-based flipped classroom teaching model can summarize many scattered microlearning lessons into a systematic whole, which integrates the unique advantages of microlearning as well as flipped classroom and has a positive impact on teaching effectiveness, and thus is widely recognized by educational scholars.

In the traditional teaching model, the transfer stage of new knowledge takes up most of the class time, and the problems that are difficult for students to understand cannot be well solved in class[1]. The flipped classroom model changes the traditional teaching model by arranging the transfer stage of new knowledge before class, students can pre-study with the help of micro-lesson videos previously prepared by the teacher, complete the tests released by the teacher on the online teaching platform, organize the knowledge they are confused about, and facilitate feedback to the teacher in class, and for this knowledge, they can discuss in groups or with the teacher, solving the problem of traditional classroom teaching. The teacher is often not around when students encounter problems and get stuck in the classroom.

2. The Current Situation of Teaching Mechanical Courses in Secondary School

2.1. Teachers Focus too Much on the Transfer of Knowledge

The phenomenon of "teacher as the main body" still exists in the classrooms of secondary vocational colleges and universities, and it is more common. In the classroom, teachers "talk" more and students "talk" less, and there is less communication between teachers and students, so students' independent creative ability is not well cultivated; some teachers, in order to complete the teaching objectives on time, do not think from students' point of view and do not consider students' ability to accept new knowledge. In order to complete the teaching objectives on time, some teachers do not think from the students' point of view, do not consider the students' ability to accept new knowledge, adopt the duck-and-egg teaching, and simply deliver the teaching contents to the students, which will only make the teachers and the books' fixed ideas bind the students, and the students are completely in a passive state, lacking the training related to practical ability, thus lacking the ability of innovation, independent thinking and independent problem solving.

2.2. Students' Professional Foundation is Weak

Most of the students in secondary schools are junior high school graduates, and some of them have poor overall quality, poor learning attitude, and low mastery of some basic knowledge. Most students are not motivated to learn, have a low probability of answering questions in class, interact with the teacher only a few times, and lack the ability to think independently; some students have developed bad study behavior habits in the previous stage, despise the evaluation of the results of exercises, homework and tests, and have a low rate of independent completion in homework[2].

2.3. The Single Way of Assessment is not Conducive to the Overall Development of Students

With the continuous progress of education reform, secondary institutions gradually pay attention to the overall development of students' problem solving, hands-on ability and comprehensive ability. However, in the teaching process of most institutions, grades are still the main index for evaluating students' usual learning; some teachers pay too much attention to the comprehensive test at the end of the semester, and the assessment still focuses on students' mastery of theoretical knowledge, seriously neglecting the investigation of students' operational ability and practical ability, without forming a multiple assessment method that includes theoretical knowledge, operational practice, as well as exercises, homework and tests. [3]The main goal of mechanical teaching is not only to help students to master theoretical knowledge, but also to improve their practical skills. The main goal of mechanical teaching is not only to help students master the basic theoretical knowledge, but also to help them develop proficient hands-on skills, but the current one-sided assessment method will suppress students' learning enthusiasm and cannot provide guarantee for a good teaching effect.

3. The Feasibility of Flipped Classroom Teaching Mode for Middle-level Mechanical Courses based on Microlearning

3.1. Increased Subjectivity and Autonomy of Students' Course Learning

At present, most secondary teachers pay too much attention to the unilateral transmission of knowledge in the classroom, and regard students as passive recipients of knowledge. In this way of teaching, students' initiative decreases and they are too dependent on teachers and lack

the ability to think alone. The flipped classroom mode overturns the traditional indoctrination teaching mode and forms a "student-oriented, teacher-assisted" teaching mode.

In the flipped classroom teaching model, students do not passively receive external information, but actively participate in information selection and processing with the assistance of teachers or others, and are active constructors of knowledge, participants and subjects of the classroom[4]. Students can decide the number of micro-lessons to be played according to their own learning situation, plan their learning progress reasonably, and make a good balance between their own learning and spare time. In the flipped classroom, the teacher gives the right to speak to the students and guides and helps them to actively complete their learning activities.

3.2. Increased Direction and Focus of Student Prep before Class

In the traditional teaching of mechanical courses in secondary school, teachers will arrange students to pre-study the course and ask them to write out what their biggest gains are in the pre-study process, what they can't understand, etc. They will also collect feedback from their classmates. After the pre-study, the teacher still follows the complete teaching procedure and lacks evaluation of the students' pre-study results, which makes the previous pre-study a formality and meaningless[5]. The teacher will record a micro-lesson video for the students before class and issue a task list, so that students can purposefully learn mechanical knowledge according to the questions in the task list, complete the homework arranged by the teacher, and organize the problems they encounter. In the classroom, the teacher will explain these problems and check the students' pre-study situation through group work, and then improve the quality of the micro-lesson according to the students' learning situation and explore effective ways of pre-study.

3.3. Significant Improvement in the Efficiency and Quality of Course Instruction

In the traditional secondary mechanical classroom, teachers habitually use "duck and filler teaching" to teach students, due to the individual differences of students, some students are not able to absorb and understand the knowledge, and it is difficult for them to keep up with the pace of teaching, and their enthusiasm for learning is obviously insufficient, so that they cannot participate in the class wholeheartedly.

The flipped classroom teaching mode mainly relies on advanced information technology and adopts the hybrid learning form of "online learning + face-to-face teacher guidance", which breaks the traditional single teaching mode, gives full play to the advantages of combining networked learning and traditional learning, and makes up for the shortcomings of only one teaching mode[6]. This new type of blended learning is not just a simple use of information technology and a simple change of traditional teaching methods, but emphasizes the organic integration of various learning elements (such as learning resources, learning environment and learning methods), i.e., the integration of microlearning resources and classroom teaching resources, teacher guidance, student independent learning and group collaboration[7]. Teachers use the limited classroom time wisely, give the classroom to students, encourage students to speak more, discuss more with teachers or classmates, and combine classroom instruction, group learning, and individual instruction to create more independent and creative learning environments and time for students.

4. Design of a Flipped Classroom Teaching Model for Middle-level Mechanical Courses based on Microlearning

4.1. Micro-course Design for Teaching Middle-level Mechanical Courses

The key to the flipped classroom teaching model is the design of micro-lessons. Teachers should carefully design micro-lesson videos according to the teaching content and students' needs to ensure the expected flipped classroom teaching effect.

4.1.1. Microlearning Should be based on the Main Line of Teaching Content and Choose the Appropriate Teaching Format

The main purpose of micro-lessons is to help students to do independent pre-study before class. A good micro-lesson is the key to realize the first step of flipped classroom. When designing a micro-lesson, teachers should take the teaching content as the main line, decompose the teaching objectives into small specific objectives, and refine the important and difficult points of teaching. If there are too many objectives, students will not be able to digest anything in the limited time, which will lead to the teaching of micro-lessons being formal and fail to achieve the purpose of promoting students' effective learning. The mechanical courses in secondary school not only involve theoretical knowledge, but also require teachers' on-site teaching and field operation. Therefore, the teaching form of secondary school mechanical micro-lesson needs to combine the characteristics of secondary vocational education, break the situation of traditional micro-lesson lecture type, and select or design a suitable micro-lesson form according to the teaching content as well as the characteristics of students[8].

4.1.2. Micro Lessons Should be Short and Concise, Practical and Interesting at the Same Time

The essence of micro-lesson is "small, interesting and real"[9]. Secondly, the micro-lesson is not a complete teaching classroom, but a link that serves the classroom and ensures a relatively complete and coherent teaching process. By "interesting", teachers are required to design micro-lessons creatively according to the age characteristics of secondary school students and the learning content, using humorous language and attractive video content to help students quickly participate in the classroom and increase learners' interest and enthusiasm in learning. By "real", it means that when designing micro-lessons, teachers should not just pursue the interestingness and ignore the fit between micro-lessons and knowledge points, but should make targeted choices in combination with teaching contents and learning characteristics of secondary school students, and effectively integrate relevant knowledge into micro-lesson design. Every student's learning comprehension ability is different, and some abstract and complicated knowledge needs to be explained several times before students can understand[8]. For example, the "Mechanical Fundamentals" course contains a large number of mechanical parts and traditional mechanisms, which require students to master the relevant general mechanical knowledge, but this course has a large number of knowledge points and complex content, and students' abstract thinking ability is weak, and they have not yet formed the ability to recognize mechanical diagrams proficiently, so they need teachers to explain it many times, repeatedly, before they can master it. Therefore, teachers should fully consider this factor when designing micro-lessons and carefully design the content of micro-lessons to ensure the quality of micro-lessons.

4.2. Teaching Process Design of Teaching Mechanical Courses in Secondary School

The teaching process design of the flipped classroom includes the following three main parts, namely, independent learning before class, interactive teaching during class, and reflection and

summary after class. Taking the chapter of gear mechanism in Principles of Mechanics as an example, the teaching process in the flipped classroom is designed as follows.

4.2.1. Independent Study before Class

Teachers should prepare students with materials for independent study of gear mechanisms before the class, such as microlearning videos on gear knot mechanisms, learning task sheets on gear mechanisms, and online test questions. In the task sheet, students are guided by questions: What are the types of gear mechanisms? What are the meshing characteristics of involute tooth profiles? What is the process of calculating the basic dimensions of a standard involute straight cylindrical gear? The correct meshing conditions and continuous transmission conditions of involute straight cylindrical gears, etc. A series of questions lead to the learning objectives of this section and help students to learn the micro-lesson video with a purpose. After watching the micro-lesson video in the micro-classroom, students should complete the test questions issued by the teacher independently to summarize the doubts they faced in their pre-class study and facilitate feedback to the teacher. The questions in the task list should be closely related to the class content to stimulate students' learning enthusiasm and initiative; the test questions should be a combination of easy and difficult, including both tests that students complete independently and questions for group cooperative inquiry to help students check their learning results[10].

4.2.2. In-class Interactive Teaching

After the pre-class micro-lesson, task list and online test, students have already mastered the characteristics and calculations of gears and involutes. First, teachers group students according to their independent study before class, and guide them to discuss in groups, so that every student can participate in the classroom to ensure teacher-student interaction and communication between students, and to develop students' group cooperation and communication skills. Secondly, teachers should filter the students' feedback according to the key points and difficulties of the teaching content, and summarize the questions that have the meaning of inquiry, and the questions should be able to meet the needs of most students. Finally, in the classroom, teachers should ask students relevant questions about involute calculations and related knowledge without interruption to encourage students to think actively and seriously to better accomplish the teaching objectives of the chapter.

4.2.3. Post-class Reflection Summary

Students have a deeper grasp of knowledge after independent learning before and during class as well as interactive learning. At the end of the class, students summarize what they have learned and reflect on their shortcomings in the learning process. They reflect on whether they were serious during the independent study before class, whether they actively answered questions during the interactive process in class, and whether they actively participated in group activities. Reflect on those questions you still don't know in class, record them, discuss them with your classmates, or take the initiative to ask the teacher for advice. Teachers should also selectively upload some extended teaching resources on the online teaching platform for students to choose on their own to help them continue to learn more deeply and improve themselves.

4.3. The Design of Evaluation System for Teaching Mechanical Courses in Secondary School

The evaluation system is an important part of the flipped classroom teaching model for mechanical courses, which plays a monitoring and guiding role for course teaching. As a new teaching mode, the flipped classroom teaching mode needs to create a diversified evaluation system. The diversification of evaluation is mainly reflected in three aspects: the object of evaluation, the method of evaluation, and the content of evaluation. First, the objects of

evaluation should be diversified, mainly including students' mutual evaluation, teachers' evaluation of students, students' evaluation of teachers and their own evaluation, etc. Secondly, the evaluation methods should be diversified, relying only on the end-of-semester exams cannot reasonably evaluate students' learning, but should combine process evaluation and result evaluation, and evaluate students' online tests before class, their answers to questions and group work during class, and their unit tests after class in a comprehensive manner. Finally, the evaluation content should be diversified to evaluate students' independent learning ability, cooperative communication ability and emotional attitudes involved in the learning process. These evaluations play an important role in the flipped classroom teaching model, so students should be evaluated in an integrated and comprehensive way considering their cognitive, process and emotional attitudinal goals[11].

5. Conclusion

With the popularity of the Internet and the increasing degree of social informatization, the flipped classroom teaching mode based on micro-lessons is gradually recognized by the public and has become one of the directions of teaching reform in vocational and technical education. Under this new teaching mode, students can effectively arrange their study time as well as after-school time to stimulate their interest and strive to learn the mechanical courses; teachers can target to solve the difficult problems encountered by students in pre-class learning to meet the educational needs of different students, which greatly improves classroom efficiency.

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