Exploration of Mechanical Principle Combined Curriculum Reform Based on Network Assisted Platform

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Abstract. The course of Mechanical Principle combined with the network aided platform has carried out the reform of mixed curriculum, that is, the combination of network and classroom, forming an Online (before class) - offline (class) - online (after class) the new form of teaching, this form has broken the traditional method of teaching, by the students to decide the content of the lectures in the classroom, give full play to students' subjective initiative, and enhance students' interest in learning. After several rounds of teaching practice, has made gratifying teaching effect.

Keywords: *Mechanical principle* · Network auxiliary platform · Curriculum reform

1 Background of the Study

With the promotion of the bottom-up teaching reform, the students who entered the university in 2017 basically are the new generation experience all kinds of teaching reform. This requires that all colleges and universities should make corresponding changes to the traditional teaching methods that have been adopted for many years. At present, there are a variety of ways to reform such as MOOC and turnover of classrooms. However, because different schools accept students at different levels and can not adopt a one-size-fits-all or one-stop teaching method, and teaching reform should be flexible according to the acceptability of students and teaching conditions [1]. The hybrid teaching reform introduced by our school since 2016 is a teaching method that combines online teaching and classroom teaching. It fully takes into account the characteristics of our students and the current hardware facilities in schools. After two years of practice, we achieved gratifying results.

2 *Mechanical Principle* Course Profile

The course of *Mechanical principle* is a specialized basic course for students in the Institute of Mechanical Engineering. To study this course, courses such as advanced mathematics, engineering drawing, physics, theoretical mechanics and basic mechanics

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are first completed. This course is offered in the fifth semester with a total of 56 academic hours, of which 42 are theoretical hours, 14 for experimental hours, and 2 weeks for the end of the semester. The *Mechanical principle* course is characterized by relatively loose knowledge, a relatively wide coverage, most of the content needs to be combined with the practical application of understanding. In order to enhance students' ability to connect with reality, the experimental class hours have been increased, the theoretical class hours decreased correspondingly, and the time for students to receive knowledge in class has been even more limited [2]. These questions all require "mechanics principle" instructor for teaching adaptability reform. Before the teaching reform, this course always adopts the traditional teaching mode. The students reflect that it is hard to learn the course, the knowledge is relatively large, the time is relatively tight, and their knowledge can not be well understood. We also conduct exploratory reforms on a small scale, but the results are not very good. After two years and three classes of mixed teaching reform, we have initially formed a hybrid teaching mode suitable for our students. We have a complete teaching plan and flexible PPT courseware, and also purchased and adapted to modify the test database.

3 *Mechanical Principle* Curriculum Reform Ideas

Based on the previous teaching experience and understanding of blended teaching methods, we conceived a set of teaching ideas for this course. Because *Mechanical principle* is a course that has close connection with practical application, we pay attention to the construction of machine and mechanism's movement and working principle. Our teaching idea is to combine the problem preview - the students ask the questions - the teachers combine the students' problems Focus on teaching - after school student feedback - online communication [3]. Knowledge guidance is through the network in the "before-class" completed. Knowledge internalization is accomplished through discussion and exchange in "Lesson", but after "after class" students are still more focused on completing higher level "knowledge inquiry".

Teachers combined with the content of each lesson to students with the practical application or the current research frontier related to guide the problem, so that students focus on the problem before class knowledge, and then through the network will not understand or want to learn more about the learning results to the teacher. Teachers in the class to focus on the above content, for students with a lesser learning effect combined with the effect of class counseling, after-school teachers and students can exchange lessons through the network learning, at the same time we can also guide students to learn through innovative content exploration, while homework is also completed through the Internet. Because we do not have the experience of network-assisted teaching, some aspects of the above model can not be modified in the learning process if it is not suitable, and improvement and enrichment can also be made in the teaching process. Due to the course after class a lot of knowledge needs to be done to consolidate the problem, not timely use of face-to-face communication can guide students practice through the network, if the effect is not very prominent, you can also explain by adding exercises, and the specific methods and methods to be based on the circumstances of specific students change.

4 *Mechanical Principle* Course Teaching Design

4.1 Teaching Reform Model

The curriculum reform of *Principles of Machinery* has gone through three stages and has been gradually improved. The current curriculum reform adopts the mode Before class (online) - class (offline) - after class (online) model, shown in Fig. 1. This model is conducive to students to complete all tasks more efficiently. In order to understand the learning purpose of each student in each class, students are asked to conduct a questionnaire on the purpose of learning before the commencement of classes so that they can be better targeted. After the end of the questionnaire is mainly on the current round of study of the effectiveness of learning from students get more advice and suggestions.

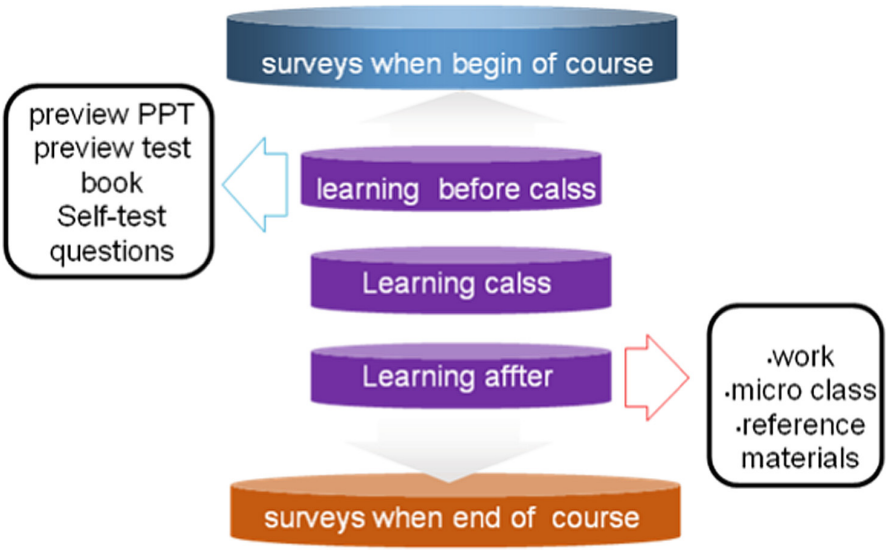

Fig. 1. Principles of Mechanics curriculum reform model

4.2 The Specific Implementation Process

(1) As this course is a combination of theory and practical application of relatively tight courses, is a thorough understanding of the theoretical basis of the premise, we apply the actual design or analysis of practical applications to find its theoretical basis. The former teaching method is that teachers fully explain the theoretical foundation in the classroom, and the combination of practical and practical part of the time without too much energy to start, the students for the boring theoretical knowledge has been passive acceptance, and failed to understand the characteristics of knowledge from the practical application. The focus of this reform is to enable students to increase interest in the learning of the course to find the starting point for learning theoretical knowledge, so that students become the guide of classroom teaching.

Before-Class (Online) Task. The advantages of using the network platform, before-class learning task is to enable students to understand the learning content of this lesson, heavy and difficult knowledge, the purpose of teaching teachers. There are three main work to be completed, simplified version of PPT, task book and test questions. PPT as a before-guide on the platform as a guide tool, according to the characteristics of student self-learning, PPT pages per lesson is best not more than 10 pages, so that students can not only see the focus but also to see. The content of the task book is divided into two parts, as shown in Table 1, part of the basic knowledge, this part of the knowledge to students can easily grasp the main requirements of students must do,

Table 1. Pre-class task book.

Mechanical Principle The fourth lesson test book

name: student number: calss: 14

content of courses: chapter three The motion analysis of plane mechanism
§ 3-1 § 3-2

emphasis: Vector equation（Velocity and acceleration analysis of the same component at two points）、velocity instant center method

difficulty: The drawing of the velocity and acceleration image、Velocity analysis with velocity instantaneous method

basic knowledge（must complete）

knowledge point	require						
	recite	understand	can do	understand the process	understand the sample	flexible use	your performance
The purpose of motion analysis		√					
analytical method		√					
Vector equation		√					
instantaneous center	√	√					
Number of instantaneous center	√	√					
distinction between relative instantaneous center and absolute instantaneous center		√					

improve knowledge（choose）

Dynamic vector equations f		√	√	√			
velocity and acceleration image		√	√	√			
Position ofinstantaneous center	√	√	√	√		√	
theorem of three centros	√	√			√		

if you can not explain why you can not do so. If 90% of the students have no problem, this part of the content can be taken by the time of class, which also saves a lot of time. Let students know what content belongs to a little knowledge before class, but also before the class via micro-channel means will be slightly about the content feedback to the students, let the students a definite target. High knowledge part is the difficult content of this class, students choose according to their ability to do, the process of class can make the ability of students to explain this part of the content. At the same time, students can also be the task book will want to in-depth understanding of the textbooks and textbooks outside the content feedback to teachers, teachers can also be targeted to prepare lessons.

The Self-test questions on the platform all come from the test bank, in addition to the usual static test questions, but also use the advantages of the network to add a dynamic test questions, dynamic test questions can come from online video or teacher shot video. This test questions allows students to intuitively understand the combination of theoretical knowledge and practical application, the corresponding knowledge will be more solid grasp. Teachers can also learn about the mastery of knowledge points through the self-test questions before class and reasonably introduce self-test questions during lecture so that students can understand why they made mistakes. Students through their self-test unit to measure their own learning, for their lack of directed listening, teachers can also find the focus of this lesson to be taught according to the students. Complete by the students to guide the classroom content to focus on the transformation of learning styles.

Class (Offline) Task. Specific to the class will be based on different classes using different forms. For small class teaching must take into account the feelings of each student, each student knowledge of the situation to take notes, during the class can use the discussion, questions, flip and other forms of teaching. For large classes of teaching can not be exhaustive, each class before the teacher randomly selected part of the students to take notes, during the class selection of different equivalent learning results feedback, try to simplify the problem, taking into account the majority of students' feeling. Because students have done a certain amount of preview work in advance, the classroom requires teachers to use some means to activate the classroom atmosphere. Since the *Principles of Mechanics* course is a very practical course, we have used a number of channels to find a large amount of news materials on the subject of video and scientific research, so that students can better understand the knowledge of fatten.

After Class (Online) Task. Another advantage of network-assisted platform is that teachers and students can narrow the distance, fully play the problem can be solved in time. At the same time, you can also make the stereotyped work rich and colorful. You can make use of a large number of animations on the Internet, or create 3D maps by yourself or research cutting-edge technologies as homework titles, and students can also make their own animated cartoon of the answer, the learned knowledge to learn and use. For those who can not keep up with the progress of lectures in class, they can also do self-study after class through the lectures recorded by teachers. For those who master the better students, you can learn more through reference materials. Many students in our college are participating in science and technology competitions of various scales. In this process, we need to use the knowledge of *Mechanical principle*,

which is not fully taught in the textbook, and will be supplemented from time to time in the reference materials. Part of the discussion of this course is done after the class platform, the setting of the part requires the teacher to seriously arrange the topic, to discuss the results of divergent features, but also practical application value. For example, "finding a kind of organization from life and production reality, making a video and drawing a sketch of the movement of its organization" combined the knowledge point of "the mechanism sketch" with the practical application. The concept of this course is "before-class preview, class for learning, after-school in-depth review."

5 *Mechanical Principle* Course Teaching Facilities

The main teaching facilities of Mechanical principle are the network aided platform and PPT courseware. The platform includes a guided version of PPT, test questions bank and test repertoire for students' before-class preview, as well as the teacher's own mini-video recorded by the teacher. The main course is mainly PPT courseware professor, part of the need to use the board to complete the courseware most of the content for the picture or animation. At the same time, the lab also provides the models or parts needed in some chapters as an aid to the lesson.

6 *Mechanical Principle* Course Teaching Facilities

After the curriculum reform of different scales, most of the students are acceptable for the curriculum reform. After the class, the questionnaire for this course was released on the platform after class. The vast majority of students reflect the curriculum reform will help students learn this course, for the understanding and mastery of the curriculum played a significant role, but also many students give pertinent comments. From the exam results can also be found in the class after the mixed class curriculum performance is much higher than the other classes, which remove the normal differences between classes, you will find that there is still much to improve performance. 14 mechanism experimental class and 15 mechanism experimental class comparison results shown in Table 2.

Table 2. 15 and 14 mechanism experimental class Mechanical principle comparative results

Course title	Class	Student number	Final exam average score	Comprehensive score average score	Final exam pass rate	Comprehensive results pass rate
Mechanical principle	15 mechanism experiment class (reform class)	17	59.82	73.82	59.41%	94.12%
	14 mechanism experiment class (reform class)	22	69.82	80.73	86.36%	100%

14 mechanism experimental class is the first mixed-class classes, from the results point of view than the 15 mechanism experimental class is much higher, in part because the latter is caused by the difficulty of the test questions, and the passing rate of the two classes is much higher than that of the non-mixed classes. However, we can see that the obvious effect of the combined curriculum reform is the mechanism of 14 classes, the parallel class performance is shown in Table 3. From Table 3, we can find that the average score of the final exam of the reform class is much higher than the other two classes. Given that the usual grade scores given on the online platform are calculated based on the students' daily accumulation, the students' learning situation is reasonably reflected. The average grade score of this class is not much higher than that of the other two classes. However, the passing rate of the final exam will be able to fully reflect the effectiveness of the reform.

Table 3. 14 class "mechanical principle" comparative results

Course title	Class	Student number	Final exam average score	Comprehensive score average score	Final exam pass rate	Comprehensive results pass rate
Mechanical principle	14 mechanism (reform class)	73	52.09	66.64	31.51%	86.30%
	14 material (control class)	54	36.00	63.43	18.36%	85.19%
	14 farm machinery (control class)	42	37.86	62.52	14.76%	66.67%

After two years of mixed curriculum reform, the reform of the *Principles of Machinery* curriculum is being gradually promoted. During the course of the reform, many difficulties have been encountered as well as a lot of experience. Although the results are both sad and pessimistic, the overall result is remarkable.

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