

# Research on the Flipped Class Based on Series of Micro Lectures

—Taking the College Engineering Major's Teaching for Example

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**Abstract—** In recent years, whether from the khan academy, TED courses, to Oxford public class, or from online courses, micro class, MOOC, etc., the transformation of the new international education information, indicates the traditional teaching of colleges, especially engineering education, has to face huge challenges. Only by active and effective exploration of the new teaching mode, can this challenge be conducted calmly. Dominated by flipped classroom, traditional teaching method is united with series of micro lecture. The research is in view of the theory teaching of college engineering course. To perform teaching reform, a course is for the test in the exploration. Both for senior college students' learning interest and learning efficiency, as well as to improve teachers' professional quality and professional satisfaction, the best balance between teachers and students is hoped to come to. The result of satisfaction survey shows that this reform is of significant effect. It contributes to the sustainable development of higher education for engineering.

**Keywords—** Flipped Classroom; Micro Lectures; Engineering Major; Higher Education; Reform

## I. TRADITIONAL CLASSROOM, FLIPPED CLASSROOM AND SERIES OF MICRO LECTURE.

The biggest difference between flipped classroom and traditional classroom is: the traditional classroom is to learn knowledge in the classroom and internalize after class; flipped classroom, on the contrary, is to learn knowledge after class and internalize in the classroom [1].

In the light of the traditional classroom, there are many advantages to flipped classroom, such as supporting for learning with technical, optimizing the learner's time and space, constructing the class which "Take the learner as the center", meeting the personalized learning needs of learners, and making the controlled learning possible so on. However, at present there are huge obstacles for the domestic university to overthrow traditional teaching mode and adopt flipped classroom completely. The first is the professional quality of teachers. Teachers are the key to the implementation of the curriculum. Teachers' professional quality determines the effectiveness of the course. Flipped

classroom teaching makes great demands for the TPCK quality of teachers, like T-technical knowledge, P-pedagogical knowledge, C-content knowledge, K-knowledge technology and so on. Therefore, the primary task of flipped classroom experiment is to promote teachers' ability of TPCK. The second is the structure of experts. At present, the main is the educational technology experts who concerning and promoting flipped classroom experiment, subject curriculum experts and teaching experts to participate in less. Educational technology experts have the advantages on technology application, the teaching environment construction, and the teaching process design, but obviously insufficient in professional teaching. If there is no curriculum and professional teaching experts to participate in research and practice, flipped classroom experiment will not go far. The third is the students' study habits. The main learning style of the flipped classroom is independent learning and cooperative learning, but the domestic university students' autonomous learning and cooperative learning ability is generally insufficient. Only let the students develop good autonomously cooperative learning habits, the flipped classroom can be carried out smoothly. Fourth is learning analysis. The advantage of the flipped classroom is that it can easily collect the students learning data, Through the study of data analysis, teachers understand the learning situation of each student, then to adjust the teaching strategy at any time, which providing students with personalized service. Therefore, the construction of the learning platform and the analysis of the learning data are very important for the implementation of the flipped classroom [2] [3].

The micro lecture means the miniature of regular course, and is the 'micro content' based on 'micro-study'. Specifically, means having a teaching design about 10-20 minutes to explain one knowledge point clearly, and show to learners by the platform of network media. Micro lecture has the advantages of high efficiency, flexibility etc. Recently, more and more colleges focus their attention on micro lecture [4] [5]. But nowadays, the researches about micro lecture on colleges are mostly focused on basic

courses teaching, few applications on engineer professional courses. Therefore, this paper selects teaching reform basic course, and explores the design and practice of the series of micro lectures and gets some achievements [6] [7] [8].

## II. APPLICATION CASES

In order to explore teaching reform of engineer professional courses on college, this paper will based on the engineer courses in senior students, and will extent to other engineer courses after get achievements and sum up experience[9] [10].

Generally, the objects of college engineering major's teaching are undergraduate students in senior. However, the enthusiasm of the college students' autonomous learning is inversely proportional to the grade. Seniors face pressure, such as employment, one's deceased father grind, going abroad is a lot to the classroom teaching of potential resistance. And such learning atmosphere is highly infectious. For this particular study group, how to break the traditional classroom teaching mode, the effective development important professional course, is a professional teacher need to think about.

### A. The Overall Implementation Scheme

The scheme implementation is shown in Fig .1

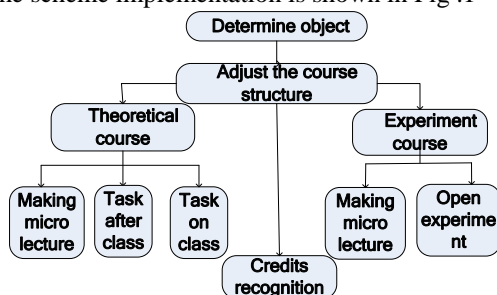


Figure 1.The Implementation Scheme for an Engineering Professional Course

### B. Adjust the Course Structure.

It will discuss theoretical course to stress the key point

#### 1) The Preparation of the Series Micro Lecture:

Power system courses common characteristic is comprehensive and physical. Comprehensive, refers to the courses with "higher mathematics", "college physics" subjects such as basic course for the support, in order to "circuit theory" and "automatic control theory" and other professional basic course, need deep foundation in science and engineering, such as the programs use a lot of vector diagram analysis method for auxiliary analysis of engineering problems, which is suitable for multimedia way, only more intuitive, and easy to understand; Physical, refers to the courses for electric power systems engineering, to solve practical engineering problems. But industrial field and it is difficult to in the traditional classroom vivid representation, such as the internal structure of substation, suitable for the rich video resources, carries on the image to knowledge transfer.

Take the example of the excellent course Power System Protective Relaying in China Jiliang University. We get good achievements to using the series micro

lecture on the BB platform, achieving the interaction between teacher and students. Specifically, this series micro lecture combines with offline class and use synchronously. The BB platform centered on micro lecture learning, having the whole course video broadcasting platform, micro lecture video platform, unit test platform, grade recording platform, community discussion platform, front professional resource sharing platform, etc. So it can realize the preliminary exploration and accumulation of flipped class. Students can get benefit a lot from the bold creative thinking and original teaching method, and it gets wide recognition. Series micro lecture has features shown as followed:

a) *Select topic careful and right.* These 6 series of micro lectures are corresponded to the 6 important knowledge points of Power System Protective Relaying. This important knowledge points are corresponding to the first 6 chapters. So this is the most important points in this course, and it can run through the whole class up, having typical representation.

b) *It's suitable for micro lecture form.* The 6 knowledge points are difficult to convey in traditional teaching mode, but is suitable in micro lecture teaching mode. The made micro lecture videos are all conforming the features of micro lecture, "short, small, delicacy, interesting". Learners can preview and review easily and can learn by themselves. It's clear and easy to understand, and explain profound theories in simple language.

c) *Production methods are professional and excellent.* Professional HD video camera and the leading level of interactive electronic whiteboard equipment in the province are used, and use professional non-linear editing software in post production, and make subtitle on video. Corresponding to the micro lecture there is related test after watching, it can record using time and grade automatically.

For an instance of one of the series of micro lectures: 4 requirements for relaying protection. The micro lesson content around the four basic requirements for relay protection, heuristic, case type, the analogy method, comparison method, the enumeration method and so on. These many kinds of teaching means give priority to multimedia courseware, teaching form of blackboard writing and live video which is complementary. It has carried on the elaborate design to teaching course. And this can convey to students teaching content easily. It reached the ideal teaching effect. The micro class content, about the dialectical unification of the four basic requirements and the contradictory relations, also is a kind of philosophy. This could inspire the students' philosophical thinking, and form scientific world views.

Form a complete set of online self-test, automatic recording, and other functions of the achievement. Also there is a discussion block online, through which students themselves to reply to each other. Thus the spirit of cooperative learning could be enhances. The e-learning BlackBoard platforms on the above contents are included. After long-term operation, it is shown well accepted by students.

2) *Ensure after Class Task: Taking Example as after the Class , and before the Class . Shown in Tab.1*

TABLE I. TASKS BEFORE OR AFTER CLASS

Time	Project	Specific contents
before class	Preview the text book	Learn new knowledge point independently
	Watch the micro lecture	Deepen understanding through micro lecture
	*Doing test after watching	Self-study through self-test
after class	Review	Review knowledge point
	*community discussion	Post questions, Reply discussion,
	*homework	Finish homework

Table 1.Specifically tasks

On the whole, In the course of the task time can be determined by the learner themselves according to the requirements of different progress learning place is also flexible with the needs. Flipped classroom is different with the traditional classroom which is fixed time fixed classroom, and it can be carried on a game clearance, in the corner of the playground, can also be a tourist, subway car on the way. People-oriented, to each according to his need, reflected the flipped classroom teaching concept of humanistic care. Among them, the project of “\*”, can carry out process monitoring, but also can be used as the assessment basis.

### 3) *Adjust the Tasks in Class:*

To establish a positive interactive learning mechanism, reflecting the characteristics of personalized instruction, is one of the important contents of this thesis. Preliminary can contain three major tasks: Discussing on the subject of the students' Questions, A free discussion of the teacher's response to the problem solving, and the characteristics of the students' mutual assistance. Specific is as shown in Tab. 2.

TABLE II. SPECIFIC TASKS IN CLASS

Project	Concrete content
Knowledge points to discuss	Learn new knowledge point independently
Do exercises	1. The thinking, methods and the answer to the question of the exercises in the course are discussed; 2. Some of the more difficult or practical engineering application background of the new class is given in the classroom, and the general questions about 3~4.
Other	Leave students free discussion.

Among them, the discussion of knowledge points, do

exercises, the other three parts of the task of the time, such as Fig .3

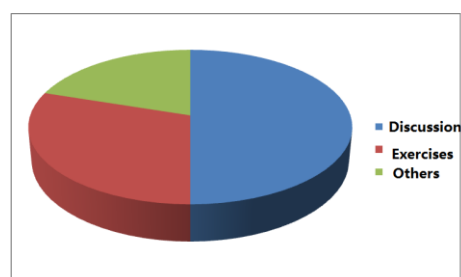


Figure 3. Time Assignment of Tasks in Class

### 4) *Credit Identification Rules*

Credit identification is an important and complicated work, and the rules of the establishment must reflect the principle of fair, just and open. The theoretical teaching reform project and the experimental course reform project of the standard “\*”, to a certain extent, realize the process monitoring, combined with the final exam results, give a comprehensive evaluation.

### C. *Satisfaction Survey and Analysis*

Survey on the satisfaction of students and teachers in the experimental class, Which is for the students, there are mainly seven problems for students which using four point scale, that is, 1- very satisfied, 2- satisfied, 3- dissatisfied, 4- very dissatisfied. A total of 90 students participated in the survey, issued a total of 90 copies of the survey, and take back 88 copies. Tab .3 Statistics of the corresponding selection of the corresponding contents in the effective scale.

TABLE III. STUDENT SATISFACTION SURVEY

Questionnaire	1	2	3	4
This way is more interesting	12	68	7	1
This way is more flexible	46	42	0	0
The way to make me more active learning	48	32	8	0
This way allows me to easily understand the learning progress of other students	20	50	15	3
I like this way	22	57	9	0
I hope that other courses will also use this way	21	52	15	0
I would recommend it to anyone else	23	55	10	0

From Table 3, it can be seen that above 91% of the students are interested in the trail course, which can stimulate their thirst for knowledge and learning initiative, and moreover, they think this learning mode is flexible. It's very surprised that can get the high ratio for senior students' engineer course learning. But, there also less than 80% of the students think that the way can easily understand the learning process of other students, and can learn relatively. Of course, do not rule out some of the students don't care about other' learning state. Nearly 90% of the students are very recognized in this new way. More than 80% of the students even hope others courses can adopt this way and want to recommend it to other students. It's easily to see that flipped class realize great learning achievement for most of the students.

In addition, there is a survey about the member took part in this reform of the teaching course. It shows that although there is a lot of previous preparation compared

with traditional teaching mode, such as route design, micro lecture taken, post processing, video upload, network maintenance and teacher-students interaction, it really provokes teacher's teaching enthusiasm and innovation consciousness, and add new vitality to the classroom and is good at the sustainable development of teaching.

### III. VI. CONCLUSION

The characteristics of the college engineering major courses are not only deeply theoretical, but also of practical engineering. Therefore, for the design of the course, except for the content of the textbook, timely introduction of the practical engineering case in the process of teaching could stimulate students' interest in learning. Thus the class effect is much better. In addition, the design of the micro class, pay attention to relate the new knowledge points with what they have learned. Moreover, this could help students to develop good learning habits.

Through the analysis of the above survey results, more and more college students have deep recognition of the new and old learning style. And they achieve "active learning", "happy learning", and "compare learning". Teachers' professional happiness will also rise abruptly. But there is also a long way to realize innovative "flipped class" from extension to intension, from form to content in the environment of "internet+".

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