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Exploration and practice of "Flipped Classroom" for engineering majors in applied undergraduate universities—A case study of building a three-micro digital classroom of structural mechanics

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Abstract: *Break the traditional classroom because it is a student-oriented teaching classroom; Create flipped micro-lessons, it is a new form of teaching in the interchange of roles; Students can take advantage of their digital strengths to create learning materials, and micro-lesson production can be realized from the student's perspective; In the process of revising the micro-lesson, students and teachers can communicate and collaborate with each other, and they achieve the complementary strengths of abilities.*

Keywords: *flip micro class; teaching link; teaching practice*

1. Introduction

Nowadays, the campus is all digital, students carry smart phones, ipads and so on at school, students are equipped with computers at home, students have many channels to complete the independent study before class. The pace of students' independent learning is as follows: open the teaching plan to find knowledge points, borrow the notes of "excellent students" to check the gaps and make up the missing, and watch the video sample questions before writing homework. The course of structural mechanics has many knowledge points, difficulty and steps. Students are in desperate need of digital classrooms and autonomous learning at their own pace. Therefore, the "three micro" digital classroom of structural mechanics conforms to the trend of The Times and emerges at the historic moment[1-2].

2. New media environment for the information age education reform inserted the wings of take-off

The combination of information and technology has changed the nature of traditional teaching and promoted the rapid development of education towards the direction of information technology. At the same time, it has also affected teachers' educational consciousness, classroom role and teaching mode. Rely on digital classroom, use micro class to teach. Intuitive and dynamic teaching materials have played a certain impact on students, and students' learning enthusiasm and classroom interaction have been improved. However, the essence of this kind of teaching structure is still traditional classroom, the only change is that students from textbooks, blackboard and other paper materials to face a streaming media resources, still teacher-centered, unable to respond to the OBE concept of centering on students' learning and cultivating students' independent learning ability and other requirements.

In fact, as early as the 1990s, Chinese electricity education circles have clearly defined the segment content of the TV textbook, as one type of electricity education textbook. The TV textbook with episodic content mentioned here is a kind of micro video, which is characterized by simple content and short time. However, at that time, the TV textbook only used the episodic content as the auxiliary material for teachers' lectures, and did not enter the classroom of schools on a large scale[3-6].

In China, Professor Hu Tiesheng is the first person to define micro-class, which comes from the Education Bureau of Foshan City, Guangdong Province. From the five dimensions of resource composition, course carrier, operation mode, learning space and learning mode, he differentiated micro-classroom, micro-lesson plan, micro-lesson example and so on. On this basis, he proposed the concept of micro-lesson, that is, according to the new curriculum standards and teaching practice requirements, teaching video is the main carrier to reflect the teacher's specific knowledge point or teaching link in the

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classroom teaching process. The organic combination of various teaching resources to carry out teaching and learning activities is obviously a micro-network course resource organically composed of various resources. Its main carrier is video, the main presentation mode is based on the network and run, and is not limited by time and space.

3. Micro lesson design strategy of flipped classroom

Zhou Minglong and Wang Hengfu boldly questioned that front-line teachers sometimes acted like a broadcaster in micro-class teaching, constantly fiddling with computers; Sometimes, he looked like a bystander, coldly watching and listening to the micro-class recorded by the teachers in the same group and himself, which resulted in less classroom interaction, less on-site problems, and less thinking collision between teachers and students. Although the teacher prepared the lesson carefully and recorded the lesson intensively before class, the class seemed dull.

Ang Juan, Yu Xin and Shui Sen pointed out in An Analysis of Micro-course Design Strategies Based on Flipped Classroom that: Micro-courses breed challenges and achieve transformation in flipped classroom. In practical teaching, micro-courses play a pivotal role, because it is the core of flipped classroom, related to the effect of pre-class knowledge acquisition, determines the design of course teaching activities, and thus affects the final teaching effect. When the two are combined, they will play a greater role. Obviously, good micro-class resources are helpful to better guide the development of flipped classroom[7-12].

In 2006, Salman Khan, a Bangladeshi American, used a simple video recording tool to create very short videos for his distant cousin to study. He found it so effective that he founded a micro-lesson education site that offers online learning, progress tracking and other services. The site clicks per month more than 200, ten thousand times, become the world's most influential micro class learning platform.

In 2008, David Penrose, senior instructional designer at Juan College in New Mexico and manager of the college's online services, formally introduced the concept of microclasses and applied it to online courses. At the same time, he also pointed out that the construction of micro lesson five steps: a list of teaching core concepts; Write a 15-30 second introduction and summary that provides context for key concepts; Record videos that are 1-3 minutes long. Designing after-school tasks to guide students to read extensively or explore curriculum knowledge; Upload teaching videos and course tasks to the course management system. □

Nowadays, "flipped classroom" has become the focus of educators and a major technological change affecting classroom teaching. Khan Academy video courses are popular all over the world. Salman Khan has released more than 3,800 mini videos, which are used by students all over the world for independent learning after class, by many teachers as auxiliary teaching tools, and in class time, they are more used to answer questions for students. The flipped classroom has been realized. Flipped classroom allows students to listen to lectures at home according to their own learning progress, and then solve questions together with teachers and classmates in class. This model not only arouses the enthusiasm of participants, but also enables students to control the pace of lectures independently.

4. To construct a teaching design system suitable for flipped classroom

The novel coronavirus pandemic has made people no longer unfamiliar with online education, and they are looking more closely at the quality of online education. Online education software wisdom Tree has complete functions, can link to Tencent conference, online broadcast; Open the recording to review; Take pictures and video to submit homework. However, students in the pre-class preview, facing the teacher's lengthy and profound speech, flinch; After class, the missing notes lazy to check the missing; It's easy to make mistakes when you write down examples in a hurry, and then make mistakes when you do them. Students not only need a classroom to assist teaching, but also need a platform to assist their own learning.

Engineering courses in application-oriented undergraduate universities are very difficult and have many knowledge points. The content of the 50-minute class is very limited. Teachers often have to repeat three times every time they learn the key and difficult points of the course, so that they can rest assured that all students can understand them. Teachers also need a "micro-teaching assistant" who can explain multiple times, from multiple angles, and swap roles[13-15].

The related knowledge points are expanded into auxiliary micro-class resources with micro-video as

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the core and micro-teaching plans and micro-notes as the supplement. It is crucial to choose the content suitable for the application of flipped micro-course teaching method, because teaching content is the center and the core of micro-video. The development concept of flipped micro-course takes a certain knowledge point as the resource organization unit, which not only pays attention to the "teaching" of teachers, but also emphasizes the design of "learning" of students. The flipped micro course must strictly design the teaching plan according to the instructional design flow chart: it is far from enough for teachers to only teach the lesson, they must develop the habit of "design", design every lesson as art, and design the teaching that can improve the learning efficiency of students[16-17].

5. Explore the way of integrating flipped micro lesson and classroom teaching design

How to integrate flipped micro class with classroom teaching so as to achieve the integration of pre-class, in-class and after-class activities? Different classes have different teaching objects and different learning abilities and characteristics. Teachers must not be dogmatic when teaching, but must learn to be flexible and adapt to the mechanism before class, in class and after class. Preparation before the course begins: Set up an online learning space. On the one hand, students' learning materials are uploaded. On the other hand, reserve micro-lesson resources for the course in the future; Embedding occurs in the course. That is to effectively integrate pre-class micro-class learning with teacher-guided classroom teaching to form an embedded relationship. The implementation of the course is carried out by class, and each class is carried out in the order of pre-class, in-class and after-class: sharing of micro-resources before class and learning of micro-class -- the teacher provides micro-class resources consistent with the content of this class before class, and students learn through mobile devices after class, and discuss and communicate with each other on problems existing in learning in the online learning space. Guidance, communication in class and assignment of different classroom assignments -- In class, on the one hand, the teacher guides students on the common problems existing in the learning process of pre-class micro-class resources; On the other hand, it organizes classroom discussions and assigns different classroom assignments to students at different learning levels. In other words, it requires students who have not mastered the basic content of the course to continue to learn micro-lessons, strengthens their understanding of knowledge points, and encourages students who have mastered the basic content of the course to take on more difficult assignments. Evaluation at the end of the course. At the beginning of the course, the teacher tells the students the instructional design process for each topic and continues throughout the course. Process evaluation is given through the class work of each class, which is continuously reinforced until the end of the course. Students submit their works independently through the online learning space, and teachers complete the summative evaluation according to the detailed evaluation criteria; Reflections at the end of the course. Excellent works that have passed the teaching test should be re-recognized and re-analyzed. In particular, excellent works of students and their learning experience can be used as a dynamic learning resource in the teaching of micro-lessons, which can better serve the study of students in this semester and even in the following semester. Based on this, after the end of the course, the students' works were evaluated according to the relevant evaluation standards, and some excellent works were selected for sorting.

6. Conclusion

The digital class of structural mechanics is "centered on student development and guided by learning results". By making short, small, precise and vigorous micro lessons on classic exercises, students can listen to and listen to them repeatedly, preview and review. Let students "reach" difficult knowledge points; By displaying excellent electronic notes of senior students, students can "touch" good notes that are difficult to borrow; The "micro teaching plan" closely linked to the outline allows students to "clear" the knowledge context. The "Three Micro" digital platform not only reflects the characteristics of the course, but also highlights the advantages of the flipped classroom based on micro lessons. Students use digital classroom to carry out independent learning and collaborative exploration, submit corresponding learning results, truly cultivate students' information literacy, information operation ability, independent learning ability, and promote the reform and innovation of structural mechanics teaching. In the days when the epidemic is normal, digital classroom can make more effective use of students' fragmented time, deliver more knowledge to everyone, and break the limitation of time and space. This is the greater significance of digital classroom.

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