

Research on Microlecture Construction of Computer Teaching in Universities

Jinli Li ^{a*}, Zongxuan Wei ^b

School of Space Information, Space Engineering University, Bayi Road, Huairou District, Beijing, China

Abstract. With the advent of the era of big data, various education models adapted to informatization and modernization are emerging. Microlectures, as a new type of educational resource, are gradually being widely applied in the field of online education. This article introduces the characteristics and advantages of microlectures, and analyzes the issues that should be paid attention to in the construction of micro course resources, and proposes a construction plan. Taking the computer courses in universities as an example, an innovative teaching method based on microlecture technology is designed to build "micro" classrooms for university computer courses, ultimately improving teaching quality and efficiency. With the continuous development of technology, microlectures will play a more important role in future university teaching.

1. Introduction

In the era of rapid information development, information literacy is a skill that everyone should have. In college computer teaching, students' basic level is different and their practical ability is poor. If only the traditional face-to-face classroom teaching method is used, students' enthusiasm for learning is not high, learning efficiency is low, and the depth of understanding of the key content of the course is not enough. Moreover, due to the limited class hours of the course, students cannot review and consolidate after class. In view of this situation, we will combine microlecture with classroom teaching to achieve flipped classroom, improve students' learning interest and autonomy, and strengthen the understanding, consolidation and expansion of the content learned.

2. Characteristics and advantages of microlectures

The 60-Second Course proposed by Professor LeRoy A. McGrew from United States and T P. Kee's One Minute Lecture is the prototype of microlectures.^[1-2] There is no unified concept of microlecture. Professor Hu Tiesheng believes that "microlecture" is a new situational online course resource designed and developed to support a variety of learning methods for knowledge points (such as key points, difficulties, doubts, examination points, etc.) or teaching links (such as learning activities, themes, experiments, tasks, etc.) of a certain discipline, with micro teaching videos as the main carrier".^[3]

The main characteristics of microlectures are: first, they are short and pithy. The duration of microlecture is usually only a few minutes, usually no more than 10 minutes, and the teaching content is not too much, mainly focusing on the key and difficult points of

teaching, or a certain teaching link. The content of microlectures is concise, and the knowledge points in the chapters are concentrated and reflected in just a few minutes. This can help students focus on learning a certain knowledge point, thereby eliminating the situation where students are bored due to long periods of time in the classroom. Second, the theme is prominent. Because of the short time, microlecture often focus on the explanation of a certain knowledge point or the design of a certain teaching link, so the theme of each microlecture is clearer, and students can select the knowledge points they have learned in a targeted way, so as to solve the problem of students' varying levels and learning progress. Third, it is convenient to use. As long as students have an Internet environment, they can use fragmented time to learn at any time, anywhere, and can learn repeatedly, improving students' autonomy, time utilization and learning efficiency. Fourth, there are abundant microlecture resources. Teachers can create various types of microlectures to stimulate students' learning motivation through audio-visual experience, including basic knowledge points, key points, difficulties, exercises, summaries, etc., which can be applied not only to theoretical teaching, but also to practical teaching, case teaching, seminar teaching, etc.^[4]

There are many advantages of applying microlectures to course teaching. The first is to cultivate students' self-learning ability. Through microlectures, students can preview before class, review after class, consolidate and improve, and virtually cultivate students' self-learning ability. The second is to stimulate students' interest in learning. Micro lessons are visually displayed with multimedia sounds, pictures, etc., so that students can have a better sense and listening experience, enhance learning fun, and stimulate learning enthusiasm. Third, it is conducive to targeted teaching. For students with poor

* Corresponding author: lijl909@qq.com

^b2414011485@qq.com

foundation, they can watch videos repeatedly after class until they master them; For students with good foundation, they can arrange extracurricular learning tasks to expand their horizons. In short, microlectures are highly interactive, diverse in types, clear in theme, short and pithy, and students can see clearly, hear clearly, and feel deeply, which can enhance learning interest and improve learning effectiveness.

3. Construction of Microlecture Resources for Computer Courses

Microlecture video is different from ordinary teaching courseware and teaching video. It should highlight the characteristics of "micro", "small" and "refined". Microlecture is not a condensed version of a class, nor a video clip of an excellent class. It is a complete teaching design in itself. When designing, we should think deeply and carefully, and carry out teaching design and deep processing for knowledge points. In terms of content, it is necessary to ensure excellence. At the same time, it is necessary to transform computer terminology into easy to understand explanations through vivid metaphors. Computer courses are highly theoretical, practical, and rapidly developing. In the teaching of computer courses in colleges and universities, to improve students' information literacy, we can not simply rely on the traditional teaching model. By designing a teaching model combined with microlectures and providing independent and diversified learning channels, we can promote the improvement of students' information literacy.

The video forms of microlectures include: screen recording, remaking, acting, etc. For different teaching contents, appropriate forms can be selected. Before the construction of microlecture, we should study and analyze the teaching objectives and content, select knowledge points and design scripts. For computer course microlectures, from the perspective of content and teaching objectives, basic knowledge point, difficulty, application improvement, expansion, ideological and political education, and professional microlectures can be constructed. Below, we will take Python programming courses as examples to illustrate each category.

3.1. Category of basic knowledge point

For the course of Python programming, basic knowledge point mainly includes Python basic syntax elements, basic data types (elements, lists, strings, dictionaries), program control structures (selection structures, loop structures), and the use of functions. In this kind of microlecture construction, the key point is to understand and master the basic knowledge points. In the microlecture courseware, attention should be paid to the embodiment of the key points of knowledge points, but not too wordy. Teachers need to use simple language to make the knowledge points clear, and set exercises synchronously, so that students can test the learning

effect. Teachers should assign exercise assignments to students to consolidate and review after class.

3.2. Category of difficulty

The microlecture of difficult points is mainly to explain the knowledge points that are difficult for students to understand. In the design of microlecture, attention should be paid to the refinement of knowledge points. In a microlecture, only one difficult point should be talked about, so that students can clearly understand the difficult problems they want to overcome. From the perspective of students, they should show students the examples that are easy to understand in rich and innovative ways, so as to improve their learning interest and reduce the difficulty of understanding. For example, object-oriented knowledge in Python is difficult to understand, which can be illustrated by the image examples of student classes, automobile classes, animal classes, etc. At the same time, knowledge points are decomposed into classes and objects, class attributes, instance attributes, class methods, instance methods, inheritance and derivation of classes, etc. For each knowledge point, design teaching ideas, image pictures, cases, etc., and the recorded content should be conducive to students' understanding after class.

3.3. Category of application improvement

Python programming course is highly practical. It is necessary to strengthen the students' practical ability to solve problems, but the computer practice hours in class are short. Therefore, we can build application promotion microlectures to enhance the students' practical ability after class. Application promotion microlectures are mainly based on the understanding of key basic content, and strengthen the understanding and learning of basic content.

The first is application case microlectures such as file reading and writing, web crawler, data visualization, etc. Teachers need to explain the basic usage of relevant modules, select typical cases that can run through the basic usage, and let students master the basic method of solving problems with relevant modules through learning. However, the third-party library of Python is huge, and each library contains many functions. Teachers cannot explain the usage of all functions, but the usage of functions is not difficult. Just check the description of the relevant library. The so-called "master introduces the door, learning skills are in their own". Teachers focus on guiding students to complete basic tasks, master the basic method of solving problems in Python, and lay the foundation for the follow-up.

The second is specialized microlectures. Students of different majors need to solve problems in different fields, such as remote sensing, navigation, measurement and control, communication and other different aerospace application directions. Teachers need to establish case microlectures for various majors. Such microlectures require teachers to understand the needs of various majors and build targeted case microlectures

according to the actual problems of the majors. For teachers of basic computer courses, they lack understanding of various fields. Teachers can communicate with teachers and students of relevant majors to determine their needs. However, such microlectures are generally only applicable to relevant majors, and the scope is not broad. Teachers need to build their own microlectures according to their tasks.

3.4. Category of expansion

Expanding microlectures are mainly to support students who are able to learn more to improve after class. The knowledge points of this kind of microlectures are not limited to the basic knowledge points that students must master, but focus on the expansion of students' knowledge, such as the application of Python in scientific computing, machine learning, artificial intelligence, and large data analysis. This part is not the basic content of program design. Students of different majors have different needs, Students can choose to learn according to their own needs.

3.5. Integration of ideological and political education

In the construction of microlectures, it is combined with video, audio, pictures and other materials to connect knowledge points with ideological and political content, and ideological and political content is silently integrated. Microlectures have changed the shackles in the traditional teaching mode in the past, and can provide more learning materials, and also can integrate the aerospace spirit and traditional culture education, and cultivate students' spirit of scientific, meticulous and continuous exploration. [5]

3.6. Brief summary

A microlecture can include different categories. For example, highlighting key content in the category of basic knowledge point microlecture, the teaching of highlighting key content; Category of application improvement microlecture content can be basic knowledge or extension; No matter what category of microlectures, they can be reasonably integrated into ideological and political elements. The most fundamental thing is that while refining the content, microlectures should highlight the key points, distinguish the levels, and go from simple to deep, which can inspire students to learn, stimulate their learning interests, achieve the basic goals of teaching, and comprehensively improve students' computing thinking ability and information literacy.

4. The Implementation Strategy of Microlectures in Computer Course Teaching

After rich microlecture resources built, teachers should apply them to class. Taking computer basic microlectures as an example, they can be applied in the following ways: introduction, interactive class, case teaching, consolidation, expansion and improvement, evaluation.

4.1. A novel way of introduction

An excellent teaching class introduction will make the teaching effect twice with half the effort. Although the direct introduction to the theme saves teaching time, it is often boring and can not effectively stimulate students' interest in learning. Create interesting learning situations with pictures, videos, music and other multimedia through microlectures, arouse students' resonance, stimulate their curiosity for knowledge, arouse students' positive thinking and improve their learning initiative. For example, when explaining the concept of system of numeration, teachers can introduce rich video and picture resources about China's eight trigrams and ancient weights and measures, which can not only enhance students' learning interest, but also strengthen their understanding of China's traditional culture.

4.2. Interactive teaching class

The main knowledge points, key and difficult points of the course are concentrated in the teaching stage, so the teaching design plays a very important role in promoting students to master knowledge. There are many knowledge points and difficulties in computer courses. Teachers can carry out online and offline hybrid teaching, flipped classroom teaching, seminar teaching, etc. in combination with microlectures. For example, for Python built-in data structure knowledge, such as list, tuple, string, dictionary and others, , micro lessons can be recorded, and students can learn videos and do synchronous exercises before class. Teachers can raise questions in class for discussion and exchange, test and summarize what they have learned. [6] In this way of teaching, teachers can make full use of the advantages of microlectures to give students the easy to understand content in a multimedia audio-visual way for autonomous learning, and carry out heuristic, exploratory and promoting learning in the classroom to achieve flipped classroom teaching combined with microlectures and help students to internalize and absorb knowledge. [7]

4.3. Progressive case teaching

In order to improve students' practical ability, it is necessary to strengthen computer experiments. In the traditional teaching method, teachers assign experimental tasks, students complete experiments in class, and teachers guide students according to their

computer problems. In this way, because there are many students and many problems, teachers can not take all students into consideration; In addition, due to the difference of students' level, their completion progress is often inconsistent. Although teachers explain the common problems that exist uniformly in the classroom, there are always some students who do not listen to or understand the content explained by the teacher because of progress problems. These problems can be solved by combining the traditional computer operation with case based microlectures.^[8] In the construction of case based microlectures, teachers should pay attention to guiding students to complete tasks proceed in an orderly way and step by step; For each step, teachers should summarize the knowledge points, analyze the mistakes and difficulties, and guide students to complete the task in continuous exploration. For example, in the object-oriented programming experiment, because the content of this part is difficult to understand and the experimental progress of students varies greatly, teachers can record microlecture video resources to guide students to complete the experiment step by step.^[9]

4.4. Intensive consolidation after class

Due to the limitation of class hours, students cannot fully grasp the knowledge in class. They need to strengthen and consolidate the content they have learned after class. In addition to basic written assignments and practical training assignments, teachers can use microlectures to guide students to carry out personalized review and summary after class, and make full use of students' fragmented time to further extend the classroom. Teachers can also carry out web-based tutoring and question answering, discuss and exchange key and difficult knowledge points, and improve students' mastery of knowledge.

4.5. Systematical expansion and improvement

With a wide range of computer knowledge, various students will encounter different problems in the future. Use extended microlectures to meet the needs of various students and expand their knowledge and skills in different fields. This type of teaching activity is mainly completed by students taking the initiative to learn after class, but teachers need to guide them in class to learn different content for different majors.

4.6. Effective feedback evaluation

Using microlectures for blended teaching and flipped classroom teaching can enhance students' initiative in learning. Teachers should carefully analyze students' learning statistics and communicate with them to make up for the shortcomings in teaching. At the same time, using learning data as a part of students' daily grades can stimulate their learning enthusiasm and improve their learning outcomes.

5. The significance of conducting micro teaching

Whether it is based on microlectures for pre class preview, classroom teaching, post class consolidation and improvement, or conducting testing and evaluation, relying on microlectures has extraordinary teaching significance and has become one of the important ways for many universities to innovate teaching models and improve teaching quality.

5.1. High participation of students enhances learning enthusiasm

In the blended online and offline classroom teaching based on micro lessons, students independently complete the learning of micro lesson videos, and then, under the guidance of the teacher, students engage in flipped classroom discussions, exchanges, and reports based on the teaching content and key and difficult points. This approach is student-centered, and the teacher is no longer the protagonist of the classroom. Instead, students are highly involved in the classroom, greatly enhancing classroom interactivity and enhancing student interest in learning. For example, for GUI design content, online microlectures mainly teach the steps and key points, and for the usage methods of numerous components, offline time is organized for students to report and communicate in groups. In the process of group preparation, students not only completed the textbook example program, but also designed richer and more extensive application examples, greatly improving their learning enthusiasm.

5.2. Focusing on problems improves learning quality

For basic knowledge points, students are responsible for self-learning microlectures, while teachers need to have a comprehensive understanding of students' mastery of the knowledge points and analyze existing problems. In offline teaching, the task of teachers is no longer to explain theories in a boring manner, but to implement targeted teaching plans based on the problems that students have. One is to conduct synchronous tests during the video learning process to check the mastery of basic and key knowledge points; The second is to carry out flipped classrooms targeting key and difficult points, and simultaneously discover and solve existing problems; The third is to conduct online or offline Q&A after class.

5.3. Short video duration improves time utilization

Students have heavy learning tasks, especially military academy students who participate in more training activities, and their time is highly fragmented. To achieve effective learning within a limited time, it is necessary to manage time effectively. Students complete short micro course learning within fragmented time, thereby mastering a certain knowledge point. From small increments comes abundance. After multiple rounds of

fragmented learning, the complex course learning tasks were ultimately completed. Note that the knowledge points of microlectures should be relatively independent, so that students can achieve success in a short period of time, rather than learning half and leaving half. For example, when explaining functions in programming, it is not possible to cover all the content in one microlecture, but to refine the knowledge points. In one microlecture, only the content of function parameters may be covered.

5.4. Intuitive vision enhances learning interest

Microlectures have a variety of presentation formats, including simple graphic and text formats, PPT recording scenarios, and live action modes. And they can also be presented in various forms such as scenario based, interactive, operational, and discussion. In addition, rich audio, images, videos, animations and other materials can be embedded, and teachers can design targeted animations, graphics, etc. according to teaching needs. Rich materials and intuitive visual experiences can greatly enhance students' interest in learning.

5.5. Abundant resources expand the adaptation level

Teachers can record rich micro lesson resources, including basics, key points, difficulties, consolidation, improvement, theoretical explanations, and practical demonstrations. Flexible content settings can improve course adaptability and expand the scope of learners. For example, in university computer foundation courses, there are significant differences in both theoretical knowledge and practical abilities among students. Therefore, students can independently choose suitable microlectures for learning based on their own level. As a public course for all majors, this course has significant differences in students' professional fields, and teachers are unable to teach professionally targeted cases in the classroom, otherwise it will lead to neglecting one aspect over the other. Rich microlecture resources can solve this thorny problem, as students choose appropriate resources based on their own majors.

6. Conclusions

The microlecture based computer courses teaching method in universities is a modern educational model in the information age, which can help to enhance students' initiative and stimulate their interest in learning. When constructing microlecture, it is also necessary to pay attention to the following points: firstly, guided by teaching objectives, analyze students' characteristics, select appropriate knowledge points, and establish targeted microlectures; Secondly, the duration of microlectures should not be too long, otherwise, like traditional classrooms, it will cause students to experience learning fatigue; Thirdly, the resources of microlectures can be more abundant, not limited to theoretical microlectures or basic knowledge

microlectures; Fourthly, we need to continuously update microlecture resources, summarize teaching experience, and improve the shortcomings in content and design; The fifth is to keep up with the times, with the rapid development of computers and technological updates, the content must also be updated accordingly. At present, major universities have launched flipped classroom teaching and blended teaching models that combine microlectures, with significant results. However, there is still a need to continuously explore how to build higher quality microlecture resources and how to better leverage the role of microlectures, in order to better promote the improvement of computer teaching quality in universities.

References

1. LeRoy A. McGrew. A 60-second course in organic chemistry[J]. *Journal of Chemical Education*, 1993, 70(7): 543-544
2. Kee T.P. The One Minute Lecture[J]. *Education in Chemistry*, 1995, (32): 100-101.
3. Hu Tiesheng. Understanding the Connotation of Microlectures and Teaching Design Methods [J]. *Guangdong Education: Comprehensive Edition*, 2014 (4): 3. DOI: 10.3969/j.issn.1005-1422.2014.04.006
4. Fan Yanrui Research on the Application of Microlectures in Computer Teaching under the Background of "Internet plus" [J]. *China New Communications*, 2022, 24 (4): 3
5. Li Yu, Luo Ling, Feng Dan, et al. Design and Practice of Microlectures for Computer Majors Integrating Ideological and Political Education [J]. *Computer Education*, 2022 (10): 110-113
6. Qiao Zhi. The Application of Microlectures in Basic Computer Teaching [J]. *Digital Technology and Applications*, 2022, 40 (5): 3
7. Mao Zhuomo. Practical Research on Flipped Classroom Teaching Mode Based on Microcourse - Taking the Course of "University Computer" as an Example [J]. *Journal of Qinghai Normal University (Tibetan Edition)*, 2022 (2): 136-143
8. Huang Chunlin, Wu Di. College Computer Experiment Teaching Based on the Characteristics of Micro Class[J]. *Integrated Circuit Applications*, 2020. DOI: 10.19339/j.issn.1674-2583.2020.10.18
9. Song Ying, Nie Yuexian. Application of case-based microlecture in computer basic course teaching [J]. *Integrated Circuit Application*, 2022 (001): 039