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Design of Online and Offline Mixed Teaching Mode for Python Language Programming

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Abstract

In order to drive teachers in our school and other universities to carry out the teaching reform of smart classroom and online and offline mixed courses, play a leading and exemplary role and explore the construction mode of online and offline mixed courses. This paper is based on the curriculum construction goal of "serving the school, driving the surrounding areas and leading the demonstration" and "guiding the discovery of wisdom, assisting the development of wisdom, guiding the application of wisdom and cultivating creative wisdom" for students. This paper combines "massive open online course+Q&A" to realize the online and offline mixed teaching mode of Python Language Programming, providing learning resources and reference for teachers and students in similar universities.

Keywords

Online and offline mixing, Teaching reform, Mixed teaching, Python language programming.

1. Introduction

Python Language Programming is a very practical basic course for computer-related majors [1]-[3], and it is also a suitable tool for data analysis, data mining and data visualization.

As early as many years ago, Python has become an introductory teaching language of programming for computer majors or non-computer majors in many foreign universities, such as Carnegie Mellon University, Massachusetts Institute of Technology, University of California at Berkeley, Harvard University and University of Toronto. In recent years, domestic colleges and universities have also opened courses related to Python programming. Python language is a simple and powerful language. Compared with other high-level languages, its syntax is simple and plain, and it is an open source scripting language. This feature makes the world have the largest open community around Python programming [4]. It is a very wise choice to use Python as an introductory teaching language for programming or as an extension course for various majors [5].

In the past teaching, Python program development mainly used traditional classroom teaching, and the teacher was the main body of teaching, which led to the problems of students' inattention, low participation and less interaction between teachers and students. For after-class time, although some teachers have assigned tasks such as after-class preview and after-class practical homework, due to the lack of corresponding assessment and evaluation requirements, most students are not enthusiastic about after-class preview, and the after-class practical homework is copied from each other, which has coping problems.

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2. First Level Heading

Part of the theoretical teaching content of this course adopts online MOOC teaching, combined with "massive open online course+Q&A" to realize online and offline mixed teaching. In the actual teaching process, in order to better connect the online MOOC resources with the physical classroom content, the "rain classroom" is used to intelligently connect each flip classroom mixed teaching link [6]-[7]. Based on the mobile internet environment, it realizes real-time interaction between teachers and students, resource push and homework tasks, improves the incentive and evaluation system to stimulate students' autonomous learning on mobile devices, analyzes students' learning situation in real time, realizes the process assessment of students' learning, and provides teachers with personalized intelligent assistant function based on artificial intelligence technology and students with personalized intelligent assistant function based on artificial intelligence technology. In the course construction, using cloud computing and big data analysis technology, firstly, the diagnosis and analysis of learning situation and group collaborative interactive learning are realized. Second, realize the sharing and co-construction of learning resources. The third is to realize the intelligent push of resources. Finally, it can realize real-time intelligent monitoring and evaluation of students' learning process.

Based on the MOOC resource of Python Language Programming on the platform of Anhui Online Course Learning Center-"E-Learning", the "Rain Classroom" is used to intelligently connect each flip classroom mixed teaching link. Mainly from the following aspects to achieve online and offline hybrid curriculum construction:

(1) realize the sharing of curriculum resources and the construction of school-based resource base.

In traditional classroom teaching, teachers usually send learning resources to students through QQ, USB flash drive or email, and the resources are scattered in the hands of teachers, which can not complete the function of intelligent push management. At the same time, teachers can't fully supervise and monitor whether students have completed the learning of learning resources. Based on the MOOC resource of Python Language Programming on the platform of Anhui Online Course Learning Center-"e-Learning", teachers can collect a large number of teaching resources provided on the platform, and modify them, build and improve them into resources that meet their teaching needs and push them to the platform.

Through the "Rain Classroom" wisdom tool, the teaching resources such as teaching plans, teaching courseware, teaching videos, exercises and test paper library of resource sharing course construction will be quickly released to the platform to complete the construction of school-based curriculum resource library.

Expand the teaching content and teaching space, through the close integration of professional knowledge education and ideological and political education, integrate value shaping, knowledge imparting and ability training, and increase the integration of multidisciplinary thinking, industrial technology and discipline theory, interdisciplinary ability, smart agriculture, natural language processing and other multidisciplinary project practices.

(2) Turn over the classroom.

Use the "rain classroom" to intelligently connect each flip classroom mixed teaching link. Teachers design teaching according to the teaching process and OBE concept, pay attention to "student-centered, learning output-oriented" and design teaching and learning activities into three stages: before class, during class and after class. The pre-class stage mainly includes the following processes: teachers release learning resources and preview tasks in advance, and students complete preview content on time and in quantity; The in-class stage includes the following activities: teachers conduct preview tests before the start of the new class, elaborate

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on the important and difficult knowledge according to the preview situation, interspersed with questions and discussions, and conduct in-class tests at the end of the class. The after-school stage includes the following activities: students review and consolidate classroom knowledge, complete practical work, expand new knowledge in group form, teachers answer questions online, and sort out feedback results. This process makes full use of the "Rain Classroom" platform to set preview tasks, complete the scoring of questions and discussions, and organize preview tests and in-class tests; Use the online compiling system to set up practical assignments, and disable the copying function. Students can compile, run and score directly after completion. The specific teaching mode design is shown in Figure 1.

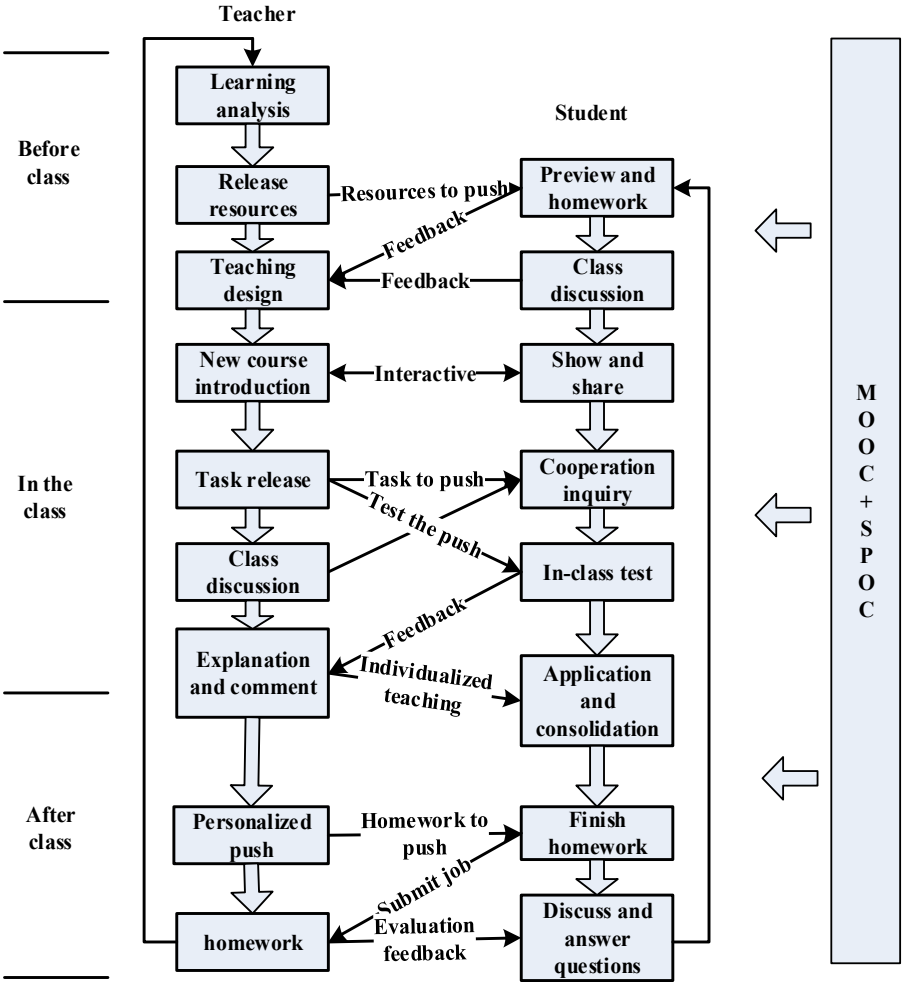

Figure 1. Design drawing of teaching mode

① before class: push resources and collect information to make classroom teaching more efficient.

Analysis of learning situation: The smart classroom platform records the learning progress of each student's resources in detail, releases "brainstorming" discussion questions and preview questions, and reflects students' participation through their experience values.

Resource Push: According to the teaching objectives and learning situation, teachers revitalize the fragmented resources in their hands, promote students' personalized learning, and push teaching resources such as teaching plans, teaching courseware, teaching videos and exercises for resource sharing curriculum construction to the platform.

Students preview: students preview the learning resources pushed by teachers to complete the preview, and record the preview.

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Discussion before class: Teachers can also flip the classroom teaching mode by publishing discussion questions and preview questions before class. In view of the problems in the preview, students can discuss and answer questions and raise questions or opinions through the platform.

Instructional design: Teachers modify the instructional design scheme according to the analysis results of learning situation, teaching objectives, teaching contents, statistical analysis and discussion of students' preview.

② Class: Develop a relaxed, interesting and efficient interactive class.

Introduction of new lessons: Teachers mainly introduce new lessons through preview feedback, evaluation exercises and creating situations, and focus on the problems existing in preview.

Presentation and sharing: In class, students can discuss in class in time by publishing discussions, show the self-study results before the discussion class, give speeches around the introduction of new lessons, share opinions, and focus on listening to the difficulties that cannot be understood in preview, and actively participate in classroom teaching.

Task release: teachers can quickly and flexibly arrange group tasks, conduct in-class tests at any time and quickly, and grasp students' learning feedback in time and quickly, so that students become the main body of teaching.

Classroom discussion: teachers quickly create discussion topics and encourage students to participate in open discussions. Students make back-to-back independent thinking speeches, and their thoughts collide. Teachers encourage students to participate in the discussion by classifying and labeling the speeches, praising them and increasing their experience values.

Cooperative inquiry: students carry out cooperative learning, mainly including group inquiry and game teaching. Students are participants, finishers and evaluators of tasks, while teachers are publishers, guides and managers of tasks. Teachers design activities to complete students' multiple grouping flexibly and quickly. The platform supports random grouping, offline grouping and fixed grouping. Students can take the initiative to explore, discuss and solve problems, and learn from passive to active. Students collaborate in groups, then submit the results and show them. Teachers can quickly annotate the results at any time, and groups can also evaluate each other.

In-class test: using the resources such as the test paper library constructed by the resource sharing course, the test question bank is built through the platform.

Explanation and comment: Based on the data analysis, teachers supplement the explanation of the weak links of knowledge points according to the evaluation feedback results, focus on the problem analysis, and solve the problems encountered by students in the new tasks through diversified interactive communication.

③ After class: Push homework, annotate in time, and answer questions anytime and anywhere.

After-school teachers can assign and push after-school homework through the resource library established by the "Rain Class" smart classroom platform, publish group after-school homework, and make quick comments anytime and anywhere to reduce the burden on teachers. Students can obtain the teacher's comments in time and correct mistakes in time. Teachers and students can interact with each other anytime and anywhere through the discussion and question answering specially designed on the "Rain Class" platform, carry out learning and discussion interaction, and stimulate students' enthusiasm for learning.

(3) To achieve big data collection and analysis of students' learning behaviors.

Push learning resources before class to check students' learning progress; Publish discussion questions and preview questions to reflect students' participation through students' experience values; Publish group tasks and discussion questions in class, and reflect students' participation through students' experience values; Test in class, timely and automatically

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feedback students' grade distribution, grade ranking and statistics of the correct rate of each question, and graphical results presentation; Push homework after class, answer questions at any time, and record students' completion through the smart platform. To sum up, the collection of big data on students' learning behaviors can help teachers transform from traditional "experience-driven" to "data-driven", which is conducive to teachers' targeted personalized education for students.

3. Optimized Design and Modularization of Teaching Resources

In order to realize online and offline mixed teaching, teachers need to complete the design and development of all teaching resources before class, find out knowledge points, skill points and attitude points according to the teaching objectives of the course, reorganize the teaching content and explore modular design through the minimum information unit composed of quantity, quality and order with mutual implication.

The teaching content of this course is divided into three parts:

The first part is the foundation of Python language, including Python overview, Python numeric types, string types and their operations, Python operators and expressions, usage of commonly used built-in functions in Python, conditional expressions and selection structures, loop structures, exception handling of programs, Python sequence structures (lists, tuples, dictionaries and collections), definition and use of functions, lambda expressions and generators, object-oriented programming, regular expressions, basic operations of files, etc.

The second part is scientific computing and visualization. Firstly, it introduces numpy library, matplotlib library, pandas library and pyecharts library commonly used in scientific computing and visualization, and then introduces the methods of data analysis and visualization by using these libraries through example analysis.

The third part is web crawler and automation. Firstly, the basic idea of web crawler is introduced, then the use of requests library and beautifulsoup4 library is introduced, and finally the design and use of crawler are introduced through examples.

In the whole teaching process, emphasis is placed on the hierarchy of knowledge, practicality and the cultivation of students' professional quality, so that students can learn to use what they have learned to solve practical problems while learning knowledge, and lay a solid foundation for graduation design and graduation employment.

The course teaching adopts the organization mode of "theory+practice", and the theoretical course leads students to learn algorithm ideas, practice and exercise their thinking and programming practice ability.

The teaching resources designed for each knowledge point are shown in Table 1:

4. Teaching Effect

Through the practice of online and offline mixed teaching in Python program open course for one semester, students' enthusiasm for self-study after class is high, the completion of preview tasks and homework after class is 100%, the majority of students have achieved good results in preview tests and classroom tests, the classroom attendance rate is basically full, and students' participation in class is also high. Through the questionnaire survey, the overall satisfaction of students is 98.1%. From the final score, the average score is improved by about 7 points compared with that of traditional classroom students. Of course, when the whole plan is put into practice, there are also problems.

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Table 1. Modular design of teaching resources and teaching design

chapter	Main teaching content	Teaching resources	Classroom form
Chapter 1 Overview of Python	Python language features, versions, and installations; Data types and operators; Introduction to MOOC learning methods.	PowerPoint courseware; Rain class push preview, review knowledge points; Instance material package.	Lectures + Exercises; Lecture + Discussion; Lecture + quiz;
	Installation of variables, built-in functions, coding specifications, Python third-party libraries.	Rain classroom push learning task list/Rain classroom push comprehensive expansion task list; Online learning resources; Micro-video; Instance material package.	Flipped classroom: take turns to show and explain, answer questions, discuss and summarize.
Chapter 2 Basic program structure	Experiment 1 Basic syntax and use of the turtle library	Rain classroom push task list; Instance material package	Practice +; Discussion +; Answer questions.
	Conditional expression, selection structure, loop structure, exception handling structure, math library	Rain classroom push learning task list/Rain classroom push comprehensive expansion task list; Online learning resources; Micro-video; Instance material package.	Flipped classroom: take turns to show and explain, answer questions, discuss and summarize.
	Experiment 2 Basic Syntax and Use of math Library (1)	Rain classroom push task list; Instance material package.	Practice + Discussion + Answer questions.
	Experiment 2 Basic Syntax and Use of math Library (2)	Rain classroom push task list; Instance material package.	Practice + Discussion + Answer questions.
Chapter 3 Combining Data types	Definition and use of lists and tuples	PowerPoint courseware; Rain class push preview, review knowledge points; Instance material package.	Lectures + Exercises Lecture + Discussion Lecture + quiz.
	Definition and use of collections and dictionaries	Rain classroom push learning task list/Rain classroom push comprehensive expansion task list; Online learning resources; Micro-video; Instance material package.	Flipped classroom: take turns to show and explain, answer questions, discuss and summarize.
	Character string, Use of jieba library, regular expression	PowerPoint courseware; Rain class push preview, review knowledge points; Instance material package.	Lectures + Exercises Lecture + Discussion Lecture + quiz.
	Experiment three combined data types and the application of thesaurus	Rain classroom push task list; Instance material package.	Practice + discussion + Answer questions.
Chapter 4 Function and surface object programming	Use of functions, classes, lambda expressions, and generators	PowerPoint courseware; Rain class push preview, review knowledge points; Instance material package.	Lectures + Exercises Lecture + Discussion Lecture + quiz.
	Experiment 4 function and code reuse example practice	Rain classroom push task list; Instance material package.	Practice + discussion + Q&A.
Chapter 5 File and Folder operations	File overview and usage PIL library, JSON library Formatting and processing of data.	Rain classroom push learning task list/Rain classroom push comprehensive expansion task list; Online learning resources; Micro-video; Instance material package.	Flipped classroom: take turns to show and explain, answer questions, discuss and summarize.
	Experiment 5 File, PIL and multidimensional data processing operations (1).	Rain classroom push task list; Instance material package.	Practice + discussion + Q&A.

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Chapter 6: Scientific Computation and Visualization	Overview and use of numpy library and pandas library	Rain classroom push learning task list/Rain classroom push comprehensive expansion task list; Online learning resources; Micro-video; Instance material package.	Flipped classroom: take turns to show and explain, answer questions, discuss and summarize.
	Overview and use of matplotlib library and pyecharts library	PowerPoint courseware; Rain class push preview, review knowledge points; Instance material package.	Lectures + Exercises Lecture + Discussion Lectures + quizzes.
	Experiment 5 File, PIL and multidimensional data processing operations (2)	Rain classroom push task list; Instance material package.	Practice + discussion + Q&A.
Chapter 7 Web crawlers and Automation	Use of requests library and Beautifulsoup4 library.	Rain classroom push learning task list/Rain classroom push comprehensive expansion task list; Online learning resources; Micro-video; Instance material package.	Flipped classroom: take turns to show and explain, answer questions, discuss and summarize.
	Experiment 6 Web crawler and automation application case practice.	Rain classroom push task list; Instance material package.	Practice + discussion + Q&A.

(1) Compared with the traditional teacher-based teaching mode, the workload of classroom teachers has increased sharply, and the usual study time invested by students has also increased significantly. Teachers not only need to prepare a series of materials in advance, but also correct some subjective assignments, and also sort out the results in time for feedback; Students need to complete tasks such as preview before class and case analysis of homework after class, which takes almost twice as long as the traditional class mode.

(2) Some teachers and students don't adapt to the new teaching mode, and the intermediate implementation links are not uniform. For example, some teachers are still full of irrigation, resulting in no time to organize classroom tests.

(3) After the whole course, there are too many tests, which make students tired of coping. Later, we should find a balance point and appropriately reduce the burden on students.

According to the existing problems, the research group conducted research and put forward to further utilize the new technology of artificial intelligence to ensure students' learning participation.

The balance between harmony and learning quality makes online and offline mixed teaching mode the main form of course teaching.

5. Conclusion

By introducing online and offline mixed teaching mode into Python language programming course, online and offline mixed teaching is implemented by using "cloud+terminal", resources are pushed, and interactive learning is carried out anytime and anywhere. Using the teaching platform of "E-Learning" and the intelligent teaching tool "Rain Classroom" to achieve dual-drive teaching, offline classroom and online teaching can achieve data fusion, courses can be built when they are connected to the platform, and resources can be integrated into the classroom when they are connected to the platform, so that diversified and full-cycle teaching data of every teaching link of "before class-after class" can be obtained and extracted, the teaching process can be digitized, and the experience in traditional teaching can be transformed into digital quantification. Through the platform, teachers can carry out personalized teaching according to students' situation tips, resource application analysis, activity development analysis, content intelligent recommendation and so on.

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