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Discussion on the Reform Mode of Computer Experiment Teaching in Epidemic Situation

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Abstract

Taking Rain Classroom as a wisdom teaching tool, this paper constructs a practical teaching mode of computer education, and applies this teaching mode to the experimental teaching of "College Computer Foundation" course for non-computer majors during the epidemic. This paper analyzes in detail the students' activities and teachers' activities in the four stages of creative generation, project design, practical experience and sharing reflection in this practical teaching mode. The practice shows that this model has achieved good teaching results, which is of practical value to students, teachers and schools, and also has reference significance for practice teaching in normal period.

Keywords

Rain Class; Computer Education; Practical Teaching; Suspension of Classes; Epidemic Situation.

1. Introduction

Affected by the COVID-19 epidemic, in the spring semester of 2020, college students in China can't return to school on schedule, and their learning style has changed from centralized school study to distributed home study. How to make use of modern information technology and teaching tools to truly "stop classes and keep learning", especially the practice teaching, which is an important part of the teaching process, is a new proposition for college teachers and a new challenge for students, such as how to conduct it in a way that teachers and students can't face each other. As a user of wisdom teaching tools in rain class and a practitioner of computer education in colleges and universities, the author carried out targeted teaching mode reform and teaching method innovation during the epidemic period, and carried out computer education practice teaching based on rain class.

2. Introduction to Rain Classroom

Rain Classroom is a smart teaching tool for higher education jointly launched by Tsinghua University Online Education Office and Xuetang Online in April, 2016. It aims to comprehensively apply modern emerging information technologies such as big data, cloud computing, machine learning and mobile Internet to teaching scenes, and provide intelligent information support for the whole teaching process including before, during and after class. Rain class has the following remarkable characteristics:

(1) Rich teaching experience and increasingly perfect product functions. Rain classroom has the functions of barrage discussion, random roll call, real-time test, etc., which enhances the interactive experience between teachers and students in the teaching process. The online exam function of Rain Classroom can effectively solve the problem that students can't take the final exam on site after the course study during the epidemic period. The developers of Rain Classroom have been committed to perfect product functions and good user experience. In March, 2020, Rain Classroom added ten new functions, such as camera supporting beauty,

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multi-screen live broadcast, large-screen learning and double-speed playback. These humanized designs further enriched the teaching experience of Rain Classroom.

(2) Data collection and analysis in the whole teaching process. Rain classroom can record the data of all aspects of teaching truthfully, objectively reflect teachers' teaching situation and students' learning situation, help teachers improve their teaching process and students' learning process, provide basis for future teaching improvement, and realize data-driven teaching.

(3) It is not limited by the teaching venue. Rain classroom makes full use of mobile Internet technology. No matter where teachers and students are, as long as they have a computer equipped with PPT or a mobile phone equipped with WeChat and connect it to the Internet, they can easily open the way of teaching and learning in Rain classroom.

(4) The "synchronization" and "asynchrony" of teaching time are really realized. Rain classroom allows teachers and students to complete a teaching activity at the same time with high concentration, and also allows students to learn the teaching resources pushed by teachers before class and watch the playback of classroom teaching live broadcast after class, which meets the individualized and differentiated needs of students in learning time.

In a word, Rain Classroom is powerful and easy to use, which breaks through the limitation of time and space in curriculum teaching, meets the needs of distributed home-based learning during the epidemic period of students, and provides the possibility for teachers to reform and innovate the teaching mode.

3. Computer Education Curriculum Teaching

3.1. Computer Education

Computer education is the result of the integration of computer culture and education and teaching. Computer education adheres to the guiding ideology of "learning by doing" and "student-centered", emphasizing that under the guidance of the goal of cultivating innovative ability, emerging technologies are the support, project implementation is the driving force, sharing and communication is the driving force, and creative works are the achievements [4]. Generally, computer education has two horizons, one is computer education, that is, how to cultivate computers; Second, computer-based education, that is, the use of computer thinking and ideas to carry out education and teaching reform and innovation. During the epidemic period, the computer education practice teaching carried out by the author based on the rain classroom wisdom teaching tools belongs to the category of computer-based education.

There are many ways to carry out computer education in colleges and universities, such as building computer space and creating computer associations, but it is undoubtedly an important way to integrate computer education with curriculum teaching. The curriculum of computer education will inevitably lead to computer education courses, referred to as computer courses for short. Different scholars have different understandings of the connotation of computer courses. The author believes that computer courses are practical teaching courses guided by the idea of computer education, aimed at cultivating computer talents, carried by computer practice projects and based on the integration of subject knowledge. The teaching of computer education course is essentially the practical teaching of computer education.

3.2. Computer Education Course Teaching Design and Teaching Stage

Scientific teaching design is an important prerequisite for the development of computer courses and an effective guarantee for the teaching effect of computer courses. Different scholars have different understandings of computer course teaching design and teaching stages. Based on the concept of the integration of computer education and course teaching, Dong

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Liming and others divided computer course teaching into five stages: creative conception, design and production, publishing and sharing, evaluation and regeneration, and crowdfunding listing with the help of micro-courses. Chen Peng believes that the learning activities based on computer projects involve six learning areas, such as innovation and ethical responsibility, and the learning activities are divided into eight stages: knowledge building, topic selection and research, creative conception, design optimization, prototype making, achievement sharing, crowdfunding and production listing. Zhang Wenlan has integrated project-based learning with design-based learning, designed and optimized the basic process of computer course learning, and divided computer course learning into four stages: beginning, project exploration, prototype design and implementation, and integrated feedback. American educational scholars regard design-based computer course learning as the main learning mode, and summarize this computer course learning as an iterative learning mode with four stages: investigation and analysis, making plans, hands-on manufacturing, evaluation and reflection. Wang Yun, etc., when studying the computer course teaching supported by Cisco Packet Tracer, divided the teaching process into three stages: teaching preparation, teaching implementation and teaching evaluation. Computer course teaching follows the general process of computer activities, but pays more attention to the cultivation of students' innovative spirit and practical ability, instead of pursuing commercial interests. Therefore, when computer course teaching is carried out in schools, we should only pay attention to the process from creativity generation to work production and evaluation and sharing.

4. Construction of Computer Education Practice Teaching Mode based on Rain Classroom

In view of the situation that teachers and students can't meet face to face and students can't communicate with each other when computer education practice teaching is carried out during the epidemic, the author combines the characteristics of rain classroom and builds a computer education practice teaching mode based on rain classroom on the basis of existing research.

4.1. Creative Generation Stage

The creative generation stage is the beginning stage for teachers to teach computer courses and students to study computer courses in the practice teaching of computer education based on rain classroom. According to the teacher's curriculum teaching plan and the distribution of knowledge points, determine the teaching theme of each computer education practice, and publish it through the "announcement" function of Rain Classroom. At the same time, teachers should comprehensively consider the selection of project themes, students' cognitive level, availability of existing resources, etc., select project resources, and push them to students in various forms such as text, pictures, voice and video through rain class. After receiving the project theme and project resources through the rain class, students need to carry out autonomous learning according to the project theme. The learning resources used by students in thematic learning can be the resources provided by teachers through rain classes, textbooks, Internet resources, etc. The purpose of project learning is to provide knowledge reserve and effort direction for the implementation of computer projects, which is related to the success or failure and quality of computer projects. Teachers should give students enough time to study the project theme, usually a few days before the implementation of the potential test.

During the epidemic period, the implementation potential test needs to be conducted through the remote online classroom. It is a teacher's test of students' knowledge reserve according to the project theme, with the aim of determining students' ability to complete computer projects. The test can be in the form of objective questions, such as single choice, multiple choice, voting, filling in the blanks, etc. in the rain class, or in the form of subjective questions. The test is conducted in real time. After the test, the rain class will immediately analyze the test situation

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and push the results to the teachers. Teachers determine the difficulty of computer projects according to the test results, which is very important to guide students to design computer projects in the later stage. At the same time, teachers need to create computer project application situations based on real problems according to project themes. Different computer projects have different situations, such as the network construction project for the actual campus, the virtual simulation innovation development project for industrial robots, etc. Teachers give targeted teaching demonstration speeches according to the created project situations, such as explaining the practical problems to be solved and the related requirements of the project through live voice or live video in the rain class, or demonstrating the use of computer tools. On this basis, students start thinking driven by practical application problems, and each student can communicate with other students in the rain class according to their actual needs (such as further clarifying their learning tasks), so as to form their own ideas and complete the creation of project ideas.

4.2. Project Design Stage

The project design stage is the key stage to transform the ideas generated in the idea generation stage into executable project schemes, involving the establishment of computer groups (computer learning communities), the formation of computer projects, the formulation of project plans and the design of project schemes. Teachers guide students to set up computer groups independently according to certain rules, generally taking into account students' interests, personality characteristics, knowledge composition, practical ability and other factors, and realizing the formation of computer groups through the "grouping" function of rain class. After the computer team is set up, the members of the team democratically select the computer team leader through recommendation, self-recommendation, etc., who is responsible for the management and implementation of the whole computer project as a whole, and the team members complete other tasks in the project design stage through brainstorming.

The computer group should give full play to the wisdom of the group, that is, students will "collide" their creativity with other members of the computer group, and elaborate and consider them from three aspects: application factors, condition factors and level factors, so as to form a computer project. The computer project should be novel, challenging and realizable. As the choice of computer project will directly affect the level and quality of computer course teaching, it should generally not be too big or complicated, and students can finish it in a short time in class.

In order to complete the computer project with high quality, each computer team needs to list the problems to be solved in the selected computer project, form a work task, and assign the task to each team member. At the same time, the computer team needs to make a project plan, including project objectives, division of labor, schedule and so on.

The project includes application background analysis, work function description, work performance index, work architecture design, expected results form, work test method, etc. The design of the project needs to be refined and optimized through full discussion, and the team members should complete the production of creative works according to the project plan. Although the project plan and the project plan have different functions, they can be combined into one in actual implementation.

The formation of the computer, the formulation of the project plan, and the design of the project scheme can all be completed by means of the "discussion area" function of the rain class. At the same time, they should be carried out under the guidance of teachers and improved and perfected according to their opinions and suggestions.

ISSN: 2710-0170

4.3. Practical Experience Stage

The stage of practical experience is the stage of transforming ideas into works, and this stage takes the production of works as the core. According to the project plan, students use computer tools to make prototypes or models with main functions, and further make computer works on the basis of prototypes. The computer tools here vary with the project. For example, the "traffic light" computer project selects the Snap+Arduino platform as the computer tool, and the "router static routing configuration" computer project selects Cisco Packet Tracer as the computer tool. After the computer work is completed, students test and evaluate the functional characteristics and performance parameters of the work according to the performance indicators in the project plan to check whether the work meets the relevant requirements. Test evaluation is the basis of computer work optimization. It is impossible to determine whether unformed design drawings or drafts meet the actual use requirements. Test evaluation can accurately find the detailed problems of the work. In response to these problems, students need to improve the prototype, and then make a computer work for the improved prototype, test and evaluate, and the whole process presents an iterative cycle until the computer work meets the requirements for use.

In the three links of prototype design, production of computer works, and evaluation of works, members of the computer group can communicate through the "discussion area" of the rain class, and exert the wisdom of the group, so as to accomplish the learning tasks in the practical experience stage together.

At this stage, teachers can provide project resources for students through the rain class, and provide project guidance and technical support according to the progress of students' projects in the rain class, so as to assist students in completing their learning tasks.

4.4. Sharing the Reflection Stage

The reflection stage is the stage of project summary, critical suggestions and ability improvement, and it is also the "closing stage" for a specific computer project. At this stage, teachers should organize students to display the project results, evaluate and exchange, summarize and reflect, and organize and submit materials in the form of words and pictures in the rain class. Students will share their project achievements, creative process, experience and so on with teachers and other students through rain class, and listen to their opinions, suggestions and evaluations. The evaluation objects include the computer project itself and individual students. The evaluation of the computer project itself includes creativity, difficulty in realization, practicality and application effect. The evaluation of individual students includes innovation ability, hands-on practice ability, spirit of unity and cooperation, etc. It can be realized by students' self-evaluation, intra-group evaluation, inter-group evaluation and teacher evaluation. According to these opinions, suggestions and evaluations, students should reflect on their performance in various stages of computer course learning, so as to improve their computer literacy. Finally, students should summarize their achievements and materials in the course of computer learning, and upload them to the rain class in Word or PDF format for teachers to review and file.

At this stage, teachers should also reflect on their own teaching process, for example, is the teaching design of their own computer courses reasonable? Is there any deviation in the implementation of computer course teaching? How to solve the existing teaching problems? What are your inspirations for your future teaching work? Finally, teachers should file all teaching materials in the rain class.

ISSN: 2710-0170

5. Computer Education Teaching Practice and Effect Analysis based on Rain Classroom

5.1. Teaching Practice

In the spring semester of 2020, a total of 32 hours of theoretical teaching and 8 hours of practical teaching were arranged in the course of College Computer Fundamentals. In the practical teaching part, four experiments, such as basic configuration of network commands and switches, VLAN division and inter-VLAN communication, basic configuration and routing configuration of routers, and integrated routing configuration, were set up, and the classroom teaching time of each experiment was 2 hours. Take the following "VLAN Division and Inter-VLAN Communication" experiment as an example to analyze the teaching situation.

According to the comprehensive statistics of Rain Classroom, 206 students participated in this experiment, and the attendance rate was 100%. In the creative generation stage, the teacher released the experimental theme to the rain class 2 days in advance, and pushed the learning materials related to the project theme to the students through the rain class, requiring the students to study independently in advance. At the beginning of the online class, teachers used the rain class to test the students' project implementation potential, and all the tests were in the form of objective questions. The test results show that the overall completion rate is 85.2%, and the correct rate is 87.7%. Among them, three people have the greatest implementation potential, and the other three people have been "warned" about their implementation potential. After the teacher created the project situation and gave the teaching demonstration speech, the students immediately conceived the ideas, and more than 200 people participated in the exchange of ideas in the rain class.

In the project design stage, 206 students set up 41 computer groups independently. After repeated discussions, the students finally formed 41 effective computer projects that meet the project theme and content requirements, worked out the project plan and designed the project scheme.

In the practical experience stage, each student independently uses the computer tool Cisco Packet Tracer to construct the network environment, write codes and conduct experimental tests on his own computer according to the project plan and project scheme of this group, and shares his practical experience in the rain class in real time to communicate with the members of this group, and then further optimizes the network environment structure, writes codes and conducts experimental tests until the experimental goal is achieved. According to the statistics of Rain Classroom, more than 600 people participated in the discussion in the practical experience stage.

In the stage of sharing and reflection, teachers organize students to communicate and share. In the rain class, students show the achievements of "VLAN Division and Inter-VLAN Communication" project, conduct evaluation and exchange, and reflect on their own gains and shortcomings. At the same time, students will summarize their own project materials and submit them through the rain class. While participating in students' sharing and communication, teachers reflect on their own shortcomings in computer education practice teaching, evaluate students' creative projects and summary materials, and file all materials in the whole process of the project.

5.2. Analysis of Teaching Effect

After the practice teaching of computer education in the experimental part of "College Computer Foundation" course, the author conducted a questionnaire survey on 206 students who participated in the study by using Rain Classroom, and collected 181 valid questionnaires, with a recovery rate of 87.9%. The survey results show that 96% of the students think that the practice teaching mode of computer education based on rain classroom has improved their

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learning enthusiasm and innovative practice ability, and they are satisfied with the course teaching. 95% of the students think that teachers can effectively guide themselves to prepare for the experiment by using rain class to publish project themes; 94.2% of the students think that the rain class can effectively help them complete their creative generation; 98.3% of the students think that Rain Classroom can effectively help their group to complete the computer project design; 98% of the students think that Rain Classroom can effectively help them finish their own works; 96.2% of the students think that Rain Classroom can effectively help them to share and reflect on the project results; 93% of the students think that the rain classroom enhances the real-time interaction between teachers and students in the practice teaching of computer education; 97.2% of the students think that the rain class can effectively help them reshape the experimental process, find existing problems, improve the learning process and achieve self-improvement.

On the basis of the questionnaire, combined with the personal experience of computer education practice teaching based on rain classroom and interviews with school teaching administrators, the author draws the following conclusions: ① For students, rain classroom is convenient to operate, powerful in function and strong in real-time interaction, which helps students to complete the learning tasks of computer education practice teaching at all stages and improves their innovative practice ability; After the end of the course, students can follow their own course learning track in the rain class, find out the existing shortcomings, and realize further self-improvement. ② For teachers, the rain classroom can help to complete the practical teaching of computer education, and the data of each stage in the teaching process are complete. It can be used not only to evaluate the quality of computer projects and students' learning effects, but also to evaluate teachers' teaching level and course offering quality, and can retain valuable teaching archives for various certifications and evaluations including engineering education professional certification. ③ For the school, the big data obtained in the course of using the rain classroom will help the school diagnose the teaching problems and improve the teaching system, so as to better provide teaching services for teachers and students and realize the real data-driven teaching.

6. Conclusion

In order to solve the problem that face-to-face practical teaching can't be carried out during the epidemic, a practical teaching mode of computer education based on rain classroom was constructed and applied to the experimental teaching of "College Computer Foundation" course for non-computer majors. The practice shows that the teaching mode has achieved good application results and has practical value for students, teachers and schools. It should be said that the practice teaching mode of computer education based on rain classroom also has reference significance for practice teaching in normal period.

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References

[1] Zhu Zhiting, Guo Shaoqing, Wu De, et al. Interpretation, key issues and countermeasures of the policy of "suspending classes without stopping" [J]. China Electronic Education, 2020(4): 1–7.

[2] Wang Shuiguo. Rain Classroom: Smart Teaching Tools in the Background of Mobile Internet and Big Data [J]. Modern Educational Technology, 2017, 27(5): 26–32.

[3] Yang Xianmin, Li Jihong. The Value Potential and Controversy of Computer Education [J]. Modern Distance Education Research, 2015(2): 23–34.

ISSN: 2710-0170

[4] Dong Liming, Jiao Baocong. Research on computer education goals and implementation paths from the perspective of core literacy [J]. China Electronic Education, 2018(9): 48–55.

[5] Chen Peng. Research on Learning Mode Based on Computer Projects [J]. Modern Educational Technology, 2016, 26(11): 13–19.

[6] Zhang Wenlan, Liu Bin, Xia Xiaogang, et al. Computer Curriculum Design from the Perspective of Curriculum Theory: Elements and Practical Cases [J]. Modern Distance Education Research, 2017 (3): 76–85.

[7] Chen Gang, Shi Jinyang. The Curriculum View of Computer Education [J]. China Electrochemical Education, 2016(11):11–17.

[8] International Baccalaureate. Design in the MYP[EB/OL]. [2020-08-10]. http://www. ibo.org/ en/ programmes/ middle-years-programme/curriculum/design.

[9] Wang Yun, Fu Rong. Computer Education Supported by Cisco Packet Tracer: Taking the Course of "Network System Design and Integration" as an Example [J]. Research in Electronic Education, 2018(5):74-78.

[10] Cui Xiangping, Zhao Chong, Lu Yuwen. Construction and Application of Computer Education Model Based on COOC Platform [J]. Modern Educational Technology, 2019, 29(2): 113–120.

[11] Hao Xinchun. Research on Teaching Practice in Computer Education: Taking Snap+Arduino Platform as an Example [J]. China Electrochemical Education, 2018(7): 129–133.