

Conception and Practice of Teaching Reform with Pad Class

Li Wang^{1, a}, Wei Wang^{1, b} and Boni Liu^{1, c}

¹Department of Electronic Engineering, Xi'an Aeronautical University, Xi'an Shaanxi 710077, China.

^awangli871016@163.com, ^bweiiwang@qq.com, ^c271629953@qq.com

Abstract

Pad Class is different from the "student-centric" of flipping classroom concept, and it is also different from the traditional "teacher-centric". It integrates the two, which is suitable for the reality of education in China, and has a medium-sized class with distinctive local characteristics. Reforming classroom teaching using the concept of pad class is of great significance to improving the quality of talent training. The paper elaborates on the concept of pad class, and its four parts are pre-class, in-class, post-class and class discussion. Combined with the author's teaching process, this paper expounds the idea of using this concept to carry out teaching reform, hoping to improve the teaching level of teachers and the learning level of students.

Keywords

Pad Class; Teaching Reform; Classroom Discussion; Signal and System.

1. Introduction

"Pad class" is a new teaching model proposed by Zhang, a Ph.D. from Princeton University and professor of psychology at Fudan University [1]. The pad classroom is neither the traditional "teacher-centered" nor the "student-centered" of the flipped classroom [2]. It integrates the two, redefines the classroom, redefines the basic categories of the education process such as the teacher-student relationship. It systematically implements the four classic learning theories in educational psychology and the three modern teaching theories in pedagogy. It is a new thing that integrates traditional educational wisdom and contains new creations [3].

The pad classroom emphasizes the internalization process and integrates the teaching method and the discussion method. It is an organic integration of teaching and discussion, rather than simple teaching plus discussion. Splitting classrooms can give full play to the initiative of students, let students become active participants in learning, radiate enthusiasm, improve efficiency, and bring personalized learning, deep learning and creative learning. Through the application of such a teaching model, passive learning can be changed to active learning, and the core qualities of critical thinking, creative thinking, communication and cooperation skills can be comprehensively cultivated [4]. The split classroom fully implements the 4C goals recommended by the international education community (after increasing cultural understanding and inheritance, it forms the latest 21st century core literacy 5Cs model proposed by the China Education Innovation Institute of Beijing Normal University), which is to implement the core in daily teaching literacy, provides an effective and highly operable landing plan.

The pad classroom increases the interpersonal interaction between teachers and students, and effectively cultivates students' social abilities such as emotional intelligence. Double classrooms put cooperation and communication into the regular learning process, and students have a lot of time to listen to each other and express themselves. Group activities provide students with opportunities to exercise and improve their interpersonal skills, enhance the sense of collective

belonging, eliminate loneliness, and enhance the friendship between students. The pad classroom is concise, easy to use, and highly operable. It strikes a balance between the concepts of "teacher-centered" and "student-centered", forming an education model with distinctive characteristics and suitable for China's educational reality.

2. Contents of Pad Class

Pad Class (teaching-homework-discussion) [5], the unfolding process is planned and designed according to the cognitive law of students' learning. The most typical dichotomy classroom contains four key links, which are lectures, independent study and homework, group discussions, and whole-class communication.

2.1. Pre-class

Before the pad class begins, the teacher should prepare a clear and complete syllabus, listing the timetable, learning objectives, learning content and activity methods of each class, as well as the students' homework, attendance and assessment methods [6]. The syllabus is a basic respect for the rights of students. Students can evaluate their input and gains in the course and estimate the final grade. Teaching becomes a common activity for teachers and students. Students need to clearly understand their learning goals and make learning plans. Teachers can clearly inform students how they are going to teach and how students need to learn, so as to maximize the protection of students' right to know. Therefore, a good syllabus is formed after full consideration of academic conditions and consultation with students, which embodies the principle of cooperative teaching and the principle of full notification.

Pad class teaching emphasizes that teaching is the common cause of teachers and students. If you don't know your partner, you will easily make mistakes in the process of cooperation. The bisection model encourages teachers to establish class chat groups or use teaching platforms [7] to keep in touch with students after class to understand their academic conditions. After the teacher has mastered the learning situation, it is important to control the student's learning burden according to the students' learning motivation, foundation, ability and course selection. Teachers can ask students to understand how much time most students can devote to this course, and then decide how much content to teach, what depth to teach, and how much homework to assign. Don't make students invest too much time and energy just because of the dichotomy, so as to avoid students' complaints.

2.2. In-class

In the pad classroom teaching, you should learn the art of blanking, draw the trunk of a tree, let students add branches and leaves, leave room for students to imagine and leave space for active exploration. Students take tasks to "fill in the blanks", which can be called "fill-in-the-blank learning" to complete the coverage of learning content and achieve "nothing is better than nothing." If the student's foundation and ability are poor, the blank space should be less, and if the student's basic teaching is good, the blank space can be more. In addition, the teaching should not be too thorough, it is for the students to delve into it in depth by themselves. Show off your knowledge and show off your level should not be the goal of the teacher's teaching. If you really want to show your ability, you must also grasp the rhythm and depth.

There are two types of dichotomy: "Dual dicing in class" means PAD is completed in one class, "dicing P and D in separate class" means that P and D are completed in class, and A is completed outside class [8]. In the case of halving in the classroom, for students with good foundation, teachers can talk less, to 60%, so that students can get enough promotion after class. For students with poor foundations, teachers can speak up to 80%, so that students will not feel too strenuous in the after-class learning process. In the case of splitting in class, the time for students to internalize and absorb is limited. Teachers generally have to give more lectures, and

only part of the content may have time to learn through discussion. Generally speaking, all the content does not need to be too clear and thorough, but for some key concepts, students need to speak clearly and thoroughly on difficult issues. In this process, it is necessary to consider the academic situation, and to measure the depth and breadth of the content for different students and majors.

Students can not only obtain curriculum resources from teachers in charge, but also use network resources to learn related online courses produced by teachers in other colleges and universities, compare the similarities and differences of different resources, establish a social learning community with other learners, and conduct learning problems that arise. In the process of participating in enterprise practice, students can have discussions with front-line technical talents, from a practical perspective, discuss the problems encountered in the learning process, and build a corporate learning community. Students can also discuss and study with the same group of practitioners, discuss the purpose and training goals of different colleges and universities, adjust their own learning direction, develop in a diversified direction, and build a student learning community. Students can also build a teacher-student learning community with teachers. From the different perspectives of students and teachers, the same problem may get different solutions to promote the "teaching" of teachers and the "learning" of students.

2.3. Post-class

The main content of post-class learning is independent study, thinking, and completion of homework. The homework is the core link that connects lectures and discussions, and is the key to the success of halving. Homework is the most important starting point for halving, and the layout of homework is very important. Students study independently based on the points raised by the teacher, and try to avoid communicating with teachers and peers in this process. The main purpose is to learn all the content by yourself, and to have a basic understanding of the content through your own efforts. During the learning process, you need to complete homework for practice and improvement. The homework for practice promotion is the necessary practice or homework for the knowledge learned. The cognitive function of this link is to allow students to have a certain understanding of what they have learned, and to lay the foundation for subsequent in-depth discussions based on understanding. What needs to be pointed out is that the content of this link takes place in class in the "half-of-class", and takes place outside of class in the "half-half".

The weight and burden of the homework should take into account the academic situation, not too much, too hard, or too heavy, otherwise there will be students coping, plans, and plagiarism. At the same time, teachers should also tell students the importance of homework, telling them that if you don't usually study it, it's like listening to the class. Even if you spend a few minutes reading and writing a few lines after class, it will be of great value. In addition, teachers should listen to students' feedback and understand their difficulties in completing assignments. The teacher should tell the students that in the halving teaching, the quality of the homework is not important. Copying a lot of things in the homework for the teacher to see is of little significance. The teacher's correction is not based on the number of words. You only need to show basic seriousness in the homework. Teachers should tell students that the purpose of doing homework is not to overwhelm other students. Although scores are important, it is more important to give play to their own characteristics and develop their abilities.

2.4. Class Discussion

At the beginning of the discussion, teachers can spend 1 to 2 minutes briefly reviewing the content and homework requirements of the previous class, and then start the discussion. The discussion is divided into 4 links, namely group discussion, teacher spot check, free questioning, and teacher summary. The order is very important and cannot be changed [9]. Among them, the sum of the last three links is called whole-class communication. Group discussion is usually

a group of 4 people, and the time is 5-20 minutes. It requires students to focus on homework, learn from each other, and solve problems together in accordance with their own gains, confusion, and difficulties.

Pad classroom emphasizes the distinction between homework and difficulty. The tasks assigned to students by teachers, even if they are given in the form of questions and thinking questions, are more suitable for being called homework. The doubts and perplexities of students in the process of completing the learning tasks assigned by the teacher or completing the homework are called difficulties. Difficulties come from the students themselves, and they arise in the course of their own learning. The core of the group discussion is to analyze the problems and help each other. The goal of split classroom teaching is to allow students to discover their own problems and express them clearly, first try to solve them through group discussion, and if they can't be solved, they can be solved through the whole class. In other words, in the ideal situation, the teacher just designs the homework, through the homework to make the students difficult, rather than designing problems for students to discuss. The process of group discussion is where students show each other their homework results, share learning experience, and answer each other's doubts.

After the group discussion, enter the whole class exchange. The first is a random check by teachers. 3~4 groups are randomly selected, and one student is randomly selected from each group to share the essence of the group discussion or raise unresolved questions. Let the students face the whole class, start with "our group", and express the opinions of the group rather than the individual. Of course, the group representatives are not designated in advance, and randomness is emphasized, so that every student may be drawn to prevent someone from slacking off. If the students who are not serious are spot-checked, they will be warned, the serious students will be spot-checked to drive the atmosphere, and the less advanced students will be spot-checked and given a chance to perform. Questions raised by students can be answered by students in other groups, which can increase student-student interaction, and can also urge the entire class to listen carefully.

Then, the teacher invites the whole class to speak freely, whether it is an individual or a group, as long as there are remaining questions, they can raise them and the teacher will answer them. Finally, take a few minutes to make a brief summary, focus on the problems that the students missed and need to be deepened and improved, and end the whole process. The time of each stage can be flexibly adjusted according to the course content and academic conditions. Generally speaking, when the content is difficult, the halving is used at the beginning, or the students have a poor foundation, teachers spend more time teaching and students spend less time discussing. When giving lectures or examination papers, you can arrange more discussion time, because the content does not need to be explained, and more is to solve problems.

From the above analysis, it is not difficult to find that there are basically no obstacles to the reforms carried out by teachers in the whole process corresponding to the traditional teaching mode. It's just a detailed explanation to the explanation of the outline, from solving the teacher's preset problem to solving the student's own problem, from the teacher's correction of homework to the student's mutual correction of homework. These changes do not require teachers to learn some new methods, and basically do not use any technical means to achieve. The most critical issue is that, through sharing teacher's experimental research, it is proved that the implementation of split classrooms effectively improves students' academic performance without increasing teachers' teaching burden, and students' performance in cooperation, communication, and creativity has also been significantly improved.

3. Conception and Practice of Teaching Reform

Through the ingenious adjustment of the core relationship between teaching and learning, the pad classroom achieves a systematic transformation from "teaching-based" to "learning-based". This novel teaching concept has improved the enthusiasm and participation of students in learning, reduced the teaching burden of teachers, and opened up a new path for promoting classroom teaching reform. Combined with the courses "Electrical and Electronic Technology" and "Signal and System" courses taught by the authors, we have some thoughts on using the concept of pad classroom to carry out teaching reform.

3.1. "Electrical and Electronic Technology"

The "Electrical and Electronic Technology" course is open to students from the School of Mechanical Engineering, School of Energy and Architecture, School of Materials Engineering, School of Aircraft, School of Vehicle Engineering, etc. It is the only basic electrical course for non-electrical students, and the course should last for one academic year. The purpose of setting up this course is to allow students to acquire the basic theories, basic knowledge and basic skills necessary for electrical and electronic technology. The course consists of two modules: "Electrical Technology" and "Electronic Technology". What we are talking about is the "electronic technology" part, the main content is semiconductor devices, basic amplifier circuits, integrated operational amplifiers, DC stabilized power supplies, integrated logic gates and combinational logic circuits, integrated flip-flops and sequential logic circuits. For these students, this is the only electrical course they are exposed to. Although there is a foundation of "electrical technology", the learning content of this semester still exist great difficulty.

In the course of teaching, we thought about the course positioning, course objectives, teaching content and teaching effects. As a non-electricity major, students cannot understand the connection between this course and their major, and cannot devote effective learning time. As a teacher, our starting point is to let students master the basic theories and practical operations of electrical and electronic technology. We will add explanations of related principles and applications in the classroom, but most students' direct starting point is to pass the exam, and the theoretical connotation is not too high. Under such contradictory conditions, how to determine the curriculum objectives and the requirements for students' understanding becomes a difficult problem. This semester's "electronic technology" content part has a total of 40 class hours, including 30 theoretical hours and 10 practical hours, which means 15 theoretical lessons and 5 experimental lessons. In the course of the explanation, it was discovered that these 15 theoretical lessons should include 6 chapters of content explanation, review lessons, and homework explanations. Many contents in the textbook can only be explained roughly. A lot of time is spent on the explanation of the exercises. Moreover, different students have different learning abilities, different levels of understanding of the same knowledge, and different final goals for the course. Under these conditions, how to balance the needs of students so that most students can meet their needs for the course is a question we have been thinking about.

Through the exchanges with other teachers in teaching seminars, we enhanced our understanding of the course "Electrical Engineering and Electronics Technology" and deeply realized the importance of this course to non-electricity students. In the course of the explanation, it is necessary to clearly distinguish the key content of the course, grasp the depth of the lecture content, present the content to the students in the most intuitive way, strengthen the classroom discussion, and enhance the students' good impression of the course. More importantly, a course group can be formed, and different teachers should strengthen exchanges and deepen their understanding of the course; they can also communicate and discuss with relevant teachers outside the school to lay a good foundation for non-electricity students. The

most important thing is that the syllabus should be sent to students before the course starts, so that students have a priori understanding of the course, what they want to learn, and why they want to learn. In this way, students can plan their studies at the beginning of the semester and devote effective time to this course to achieve their learning goals. When explaining the content of the basic logic gate circuits, teachers can outline the basic working principles and composition methods of the three basic AND gates, OR gates, and NOT circuits. Through group discussion, let students discover the three gate circuits. This is very beneficial for improving teaching effects and meeting the learning goals of different students.

3.2. "Signal and System"

The "Signals and Systems" course faces students who are college students. The most difficult thing is how to compile an appropriate syllabus and teaching plan to let students clarify their learning tasks and goals. Especially for application-oriented students, the main goal is how to enable students to transform theoretical knowledge into applied practice and improve application ability. This is the focus of our consideration when choosing teaching content. Before the course started, we carefully studied the training plan of the major and determined the status and role of the course in the major. Combined with the selected textbooks, we formulated the syllabus and teaching plan. In the first class, the teaching plan and syllabus, as well as the assessment method of the course, were announced to the students, so that students fully understand what the course is to learn, how to learn, what the goal is, and at least the overall study of the course.

In the classroom teaching process, we also make full use of the concept of split classrooms, hoping to improve students' learning ability. For example, when the concept of "signal" was introduced in the first chapter, a large number of life-like examples were used to explain it, so that students could have an intuitive understanding of the mathematical concepts they first encountered. In the second class, 5 minutes were used to allow students to describe their understanding of the concept of "signal", which resulted in lively discussions. The students' performance in class was relatively good, which helped to enhance students' enthusiasm for learning this course. When explaining the solution process of linear systems, the different solutions of zero-state response, zero-input response and full response require students to be able to fully distinguish and master. In fact, the content of this part is very complicated and the students' understanding ability may not be reached; Therefore, we have applied the method of "dividing each other", spend a lot of time in the first class to explain the calculation process and principles to the students, and arrange the exercises for the students to complete after class. In group discussions, students put forward the problems and difficulties they encountered in the course of doing homework, and the group students answered them. Then during the exchange process of the whole class, we found the common problems of most students and completed the summary of this knowledge point. In terms of experimental design, it also takes a lot of energy. Considering that students have a relatively weak mathematical foundation, the main goal of the experiment is to allow students to complete simple program design, so that students can grasp the relationship between the output and input of the signal after passing through the system.

After the initial reform of the classroom teaching mode, in general, the students' enthusiasm for the course of "Signals and Systems" has been maintained relatively well. In particular, students are able to conduct independent discussions during non-class time, and often communicate teaching content and difficult problems in homework through the Internet, which fully demonstrates that students can accept the teaching mode of pad classrooms and improve their ability to learn independently.

4. Conclusion

The thesis elaborated on the four links of the pad classroom concept, including pre-class, in-class, post-class and class discussion. Based on the requirements of applied undergraduate colleges for talent training, combined with the author's "Electrical and Electronic Technology" and "Signal and System" classroom teaching process, this paper analyzes the necessity and feasibility of using the pad classroom concept to carry out teaching reforms. In particular, after the simple practice of the pad teaching model on "Signals and Systems", the students' learning initiative and learning ability have improved, which fully proves that for educators, only continuous thinking about educational concepts, could improve the level of teacher education and the level of student learning ability.

Acknowledgements

This work was supported by the National Natural Science Foundation of China (grant number 61901350); Higher Education Research Project of Xi'an Aeronautical University (grant number 2019GJ1006) and Science Research Fund of Xi'an Aeronautics University (grant number 2019KY0208).

References

- [1] Zhang Xuexin. The new wisdom of Chinese education in bisection classroom [M]. Beijing: Science Press, 2017.
- [2] Wu Qinger. The design and practice of the "Two Three Seven" teaching mode in the flipped classroom [J]. Journal of Liaoning Vocational College, 2017, 19(8): 26-29.
- [3] Li Jing. Comparative analysis of split classroom and flipped classroom [J]. Journal of Liaoning Vocational College, 2017, 19(9): 48-49, 54.
- [4] Wang Yuqiong, Xie Changjiang. Research on the application of bisection classroom in higher vocational English teaching [J]. Innovative Education Research, 2019, 7(4): 522-528.
- [5] Liu Qiaoru, Xue Lingwei. The application of "halving classroom" teaching mode in the teaching of synthetic organic chemistry [J]. Educational Progress, 2019, 9(4): 417-421.
- [6] Fu Yonghu, Liu Junqing. The exploration and practice of bisection classroom in the teaching of "Land Use Planning" in colleges and universities [J]. High Education Journal, 2019, (23):81-83.
- [7] Xu Yue. The application research of bisection classroom in C language course teaching in higher vocational colleges [J]. Liaoning Higher Vocational Journal, 2018, 20(10): 50-52.
- [8] Shen Zhijuan, Cao Yiqing. The application of "PAD dichotomy" classroom in the application-oriented transformation of electrical basic experimental teaching [J]. Educational Progress, 2019, 9(2): 104-107.
- [9] Zhou Jing. The practical application of the halving classroom teaching model based on the Lanmoyun class -Taking the modern Chinese course as an example [J]. Liaoning Higher Vocational Journal, 2019, 21(8): 39-41, 52.