ISSN: 2472-3703 DOI: 10.6911/WSRJ.202007_6(7).0012

Teaching Reform Strategies for "Signal and System" Using Flipped Classroom Concept

Li Wang[1, a, *], Wei Wang[1, b] and Boni Liu[1, c]

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

[a]wangli871016@163.com, [b]weiiiwang@qq.com, [c]271629953@qq.com

Abstract

The use of flipped classroom concepts for classroom teaching reform is of great significance for improving the quality of talent training in applied undergraduate colleges. "Signal and System" course is the main professional basic course of electronic information major, which is a key course for application-oriented undergraduates to cultivate application-oriented talents. The traditional classroom teaching model has seriously affected students' ability to absorb and digest knowledge. With the help of flipped classroom concept, three strategies are proposed in this paper for teaching reform, including the integration of curriculum and teaching, the construction of collaborative innovation for learning activities, the rebirth of "learning and teaching" concept. It is expected to improve students' understanding and application about the course to meet the requirements of applied undergraduate colleges for talent training.

Keywords

Flipped Classroom; Applied Undergraduate Colleges; "Signal and System"; Teaching Reform Strategies.

1. INTRODUCTION

The flipped classroom concept originated from the Peer Instruction method that emerged in Harvard in the 1990s [1]. After more than thirty years of development [2], it has become one of the most popular classroom teaching forms in the world. With the social development and economic needs, the Ministry of Education supports undergraduate colleges that are positioned in the service of local economic and social development, to implement comprehensive reforms and transform into universities with applied technology types [7][8]. The transformation and development includes the transformation of school running type, the transformation of talent training model, and the transformation of the curriculum system. Among them, the transformation of the talent training model directly affects the quality of education and teaching in colleges and universities, and is a key factor for the success of the transformation. Aiming at the development needs of application-oriented undergraduate colleges and universities, it is a meaningful educational exploration to reform the classroom teaching of application-oriented undergraduate colleges with the help of flipped the classroom concept, cultivating new classroom teaching models [9].

The "Signal and System" course [10]is the main basic course for electronic information, communication engineering, electrical engineering and automation and other electronic information majors. It is also one of the relevant professional entrance examination courses for graduate students. For social development, after entering the era of information and intelligence, the development of technologies such as wireless communication, optical

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202007_6(7).0012

communication, cloud computing, microelectronics, artificial intelligence, and big data processing are inseparable from the application of relevant knowledge of "Signals and Systems". For students at school, the content of the "Signal and System" course is the basis for the relevant professional courses such as "Circuit Analysis", "Digital Signal Processing", "Digital Image Processing". The basic concepts and theories of the "Signal and System" course will be extensively used. If the learning ability of this course "Signal and System" is insufficient, it will affect the absorption of many subsequent courses.

Analyzing the necessity of current "Signal and System" teaching reform, with the help of flipped the classroom concept, the thesis puts forward the teaching reform strategy for this course, and hopes to improve students' learning ability through practice. The organizational structure of the paper is as follows. The first part explains the importance of teaching reform to the transformation and development of applied undergraduate colleges. The second part analyzes the current teaching mode of "Signal and System" and explains the necessity of teaching reform. The third part studies the strategy of teaching reform for "Signal and System" course under the concept of flipped classroom. The fourth part gives the conclusion.

2. NECESSITY OF TEACHING REFORM

The traditional curriculum teaching is centered on the curriculum, and the curriculum is regarded as the ultimate service object of the teaching activity. The teacher transmits the content of the teaching material to the students. The student understands the information in the text of the teaching material. . The focus of teacher is "teaching" and the focus of students is "learning". Students are very passive in these learning activities under the guidance of "teaching". After the teacher formulates the syllabus and course learning content, indoctrination is used in the classroom. The student is only an audience learner. After passively listening to the teacher's explanation, the course learning will end. This learning method is typical "Listening for learning".

In just 45 minutes, the teacher transmits a large amount of formula derivation process or signal analysis theory to students through the form of blackboard or PPT. Students may not keep up with the teacher's teaching rhythm, let alone the content. Under this teaching mode, the teaching content of teachers is often solid, and it will not be updated with the development of society, and it cannot meet the talent training standards of students under the new environment and the requirements of society for students. The usual learning status of the students is usually listening to the sky books, and the surprise training is near the exams, just to complete the assessment tasks of the course.

In traditional teaching activities, under the learning method of "listening for learning", teachers do not consider students' acceptance of knowledge, only complete their own teaching tasks, and do not discuss and communicate with students. The teacher did not spend time and effort to combine the knowledge in the classroom with the practice in the society, nor did he inform the students of the connection between this course and the prerequisite and follow-up courses before the course began. The students could not apply the knowledge they learned for practical activities, it is impossible for students to master the importance of this course in the entire learning process. Therefore, under the influence of traditional learning methods, the students who are about to graduate can not master the core essence of the courses they have learned, nor can they apply the knowledge they have learned to practice.

In the context of the construction of application-oriented undergraduate colleges, it is necessary to cultivate application-oriented talents who can adapt to social development and needs. The traditional "Signal and System" classroom teaching activities have seriously hindered students' ability to absorb and digest knowledge. Students are only instilled with theoretical knowledge, and they cannot apply this theoretical knowledge to practical activities

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202007_6(7).0012

at all. Even if the relevant experiments of the "Signal and System" course are set up, including the operation of the hardware experiment platform and the simulation of the software experiment platform, the cultivation of students' practical ability by these relevant experiments is far from the society's requirements for applied talents.

The concept of flipped classroom has completely reformed the traditional classroom, changing the focus of classroom teaching from "curriculum" to "teaching", from teacher's "teaching" to students' "learning", and from "listening for learning" to "doing for learning" [11]. These changes are the three cascades of today's classroom teaching reform. If these three changes can be realized gradually, it will be able to complete the deep reform of classroom teaching and improve the teaching effect of the course and the learning effect of students. Taking the course of "Signal and System" as an example, discuss the necessity of classroom teaching reform and the strategy of classroom teaching reform.

3. TEACHING REFORM STRATEGIES

Flipped classroom concept has important implications for the classroom teaching reform of "Signals and Systems". Under the concept of flipped classroom, the following strategies can be adopted: including the integration of curriculum and teaching, the construction of a collaborative innovation body of learning activities, and the completion of the rebirth of "learning and teaching". The learning quality of students and the teaching effect of teachers could improve the training quality of applied talents to meet the development needs of applied undergraduate colleges.

3.1. Integration of Curriculum and Teaching

The integration of curriculum and teaching is reflected in three aspects. Firstly, the rich form of curriculum can promote the deep development of teaching activities. Teachers must spend enough time to design course activities. Even the same courses must be constantly changed according to the students' situation. Teachers need to prepare more teaching plans to respond flexibly. For example, in explaining the basic signals of "Signals and Systems", teachers not only explain the names and mathematical expressions of basic signals to students, but also demonstrate the generation process of these signals by using an oscilloscope in the classroom. In this way, not only can students quickly understand the types of basic signals, but also can connect the rigid signals in the textbook with flexible industrial production practices, and cultivate the habit of thinking from theory to practice [12].

Secondly, the appropriate opening of the curriculum boundary can absorb multi-channel teaching resources and information. For example, when explaining the stability of "Signals and Systems", teachers can not only give the mathematical meaning of system stability in the classroom or video, but more importantly, teachers can bring students to participate in industrial production practice, to observe the impact of system stability or instability on industrial production, so that students can deepen their understanding of the degree of stability on the system. In the course of enterprise practice, students can increase their understanding of industrial production and understand their own development direction and goals. In the same way, teachers can update their knowledge of the course "Signal and System" during the process of leading the team to participate in enterprise practice, gain diverse experience, and improve the teaching effect [13].

Thirdly, whether the course resources can be recycled also determines the effectiveness of teaching activities. For example, in traditional teaching activities, if the teacher explains in the form of a blackboard, students will not be able to recall the teacher's teaching content after class. In the process of classroom teaching reform, teachers can make course resources into the form of videos, and students can take out videos for learning at any time, and record the questions

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202007_6(7).0012

generated during the learning process. At the same time, students can also learn the "Signals and Systems" course explained by other teachers through other channels, and find problems by comparing with their own teachers to complete deep learning. Through these methods, teachers and students are no longer restricted to traditional textbooks, but open their horizons and accumulate learning and teaching experience through multiple channels and methods to improve teaching effects.

3.2. Construction of Collaborative Innovation for Learning Activities

Constructing a collaborative innovation body for learning activities is reflected in three aspects. Firstly, build a social learning community for students in a virtual learning community. When students study the course "Signals and Systems", the network resources they use are not only the videos made by their teachers, but also the related network courses made by teachers in other colleges. They can compare the similarities and differences between different resources and other learners. Establish a social learning community to discuss learning problems and propose solutions.

Secondly, build a student learning community established by students in the question discussion. For example, in the course of inverse Z transform of discrete signals in the course of "Signals and Systems", some students can learn to use partial fraction expansion method to solve, some students can use the residue method to solve, and some students can learn to use the power series method. After the three methods are completed, different groups can discuss with each other for the applicability, similarities and differences, and difficulty of the three methods. Finally, a summary of solving the inverse Z transformation can be given.

Thirdly, build a teacher-student learning community where students communicate with teachers in the classroom. Students can communicate with teachers for learning problems that cannot be solved after the problem discussion. In the process of explaining the learning content, teachers may be limited by their own understanding of the course, and the learning content given is relatively fixed. After students use the self-directed learning method to generate unusual learning problems, through communication with teachers, they can not only solve the students 'problems, but also change the content of the teachers' teaching. For teachers and students, establishing a teacher-student learning community [14]is a win-win thing.

3.3. Rebirth of "Learning and Teaching" Concept

The rebirth of "learning and teaching" is reflected in two aspects. Firstly, the best state of classroom teaching is teaching and learning becoming together [15][16]. For example, when talking about the concept of a linear time-invariant system, students are free to give examples of the systems encountered in life, and explain whether the system has linear and time-invariant properties. During this period, teachers can record the listed systems without interfering with the students ’free discussion, and finally discuss with the students to determine the nature of the system. This way can deepen students' understanding of relevant knowledge, and also enable students to learn to make an inference and broaden their thinking.

Secondly, classroom teaching is more concerned with the initiative and advancement of "learning". Traditional classrooms always focus on teachers' "teaching" in the classroom. In the process of teaching reform, the prerequisite of "learning" means that students must carry out effective learning activities in advance, that is, they must be serious before class to learn related course videos or other course resources made by teachers. The initiative of "learning" means that students must be proactive, change the original passive learning state, and develop the habit of finding and solving problems. In the teaching activities, there must be a teacher's guidance process, but this guidance must be auxiliary, and must be aimed at solving the learning problems generated by students after active learning.

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202007_6(7).0012

Through the above-mentioned reform strategy, students' interest in learning "Signal and System" course is greatly increased, and students' subjective initiative is improved. Students no longer need to passively listen to the teacher's "teaching" in the classroom, but to learn the content of the course by self-study before the class, record learning problems, and communicate with classmates and teachers in the classroom. Furthermore, students and teachers can truly combine the theoretical knowledge learned with industrial production practice by participating in enterprise practice, and clarify the guiding role of the relevant content of the "Signal and System" course on production practice, according to the requirements of application-oriented talent training. We can focus on studying more in-depth learning content, lay a solid foundation for future study and work, and improve the quality of talent training in applied undergraduate colleges.

4. CONCLUSIONS

Based on the requirements of application-oriented undergraduate colleges for the cultivation of talents, the thesis analyzes the problems in the current teaching model of "Signal and System" and explains the necessity of teaching reform. Teaching reform strategies for the "Signal and System" classroom is presented, including the integration of curriculum and teaching, the construction of collaborative innovation for learning activities, and the rebirth of "learning and teaching" concept. It is expected to enhance students' learning initiative and learning ability to meet the requirements of application-oriented undergraduate colleges, as well as enhance students' personal development potential and expand students' horizons.

ACKNOWLEDGEMENTS

This paper 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] E. Mazur. Peer Instruction: A User's Manual [M]. New Jersey: Benjamin-Cummings Publication Company, Prentice Hall Series in Educational Innovation: 1996.

[2] C. H. Crouch and Eric Mazur. Peer Instruction: Ten Years of Experience and Results [J]. American Journal of Physics, 2001, 69(9): 970-977.

[3] Rscapin. Lectures Are Homework in Schools Following Khan Academy Lead [R]. DawsonITE Edtech, 2011.

[4] J. Bergmann and A. Sams. Flipping for Mastery [J]. Educational Leadership, 2014, 71(4): 24-29.

[5] S. He. Technology Changes the Classroom, Culture Shapes the Soul of Education—Chongqing Jukui Middle School takes “Flip classroom” as a Breakthrough to Promote the School's Overall Reform [J]. Education Today, 2013, 1(10): 15-17.

[6] X. Shi. More than 20 High Schools Across the Country Jointly Created the C20 MOOC Alliance Online Public Course [EB/DL]. Aug, 2013. http://www.jyb.cn/basc /xw/201308/ t20130814 _548092.html.

[7] Ministry of Education, the National Development and Reform Commission, the Ministry of Finance, the Ministry of Human Resources and Social Security, the Ministry of Agriculture, and the Poverty Alleviation Office of the State Council. Notice on printing and distributing the "Construction Plan for

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202007_6(7).0012

Modern Vocational Education System (2014-2020)" [EB/OL]. , http://old.moe.gov.cn /publicfiles/business /htmlfiles/moe/moe_630 /201406/170737.html, Jun, 2014.

[8] Ministry of Education, the National Development and Reform Commission, the Ministry of Finance. "Opinions on Guiding Local Ordinary Undergraduate Universities to Be Applied Colledges" [EB/OL]. Oct, 2015. http: // www. moe. edu. cn/ srcsite / A03/ moe_1892 /moe_ 630 / 201511 / t20151113_ 218942. html.

[9] L. Hao, Y. She. On the Implication of Flipped Classroom for China's Contemporary Curriculum Reform [J]. Comparative Education Review, 2015, 1(5): 80-86.

[10] X. Shi, X. Cheng, Z. Hao. Signal and System [M]. Beijing, Tsinghua University Press, 2016.

[11] D. Zhang, N. Guo. Construction of Flipped Classroom Model based on the Goal of Training Applied Talents [J]. Education and Vocation, 2019, (13): 85-91.

[12] J. Wang, H. Zhang, X. Cui. Study on Case Teaching in Signals and Systems Based on Flipped Classroom [J]. Journal of Electrical & Electronic Education, 2019, 41(1): 87-90. DOI:10.3969 /j.issn.1008-0686.2019.01.023.

[13] F. Xie, Y. Wei. "Unification of Knowledge and Action" in Applied Undergraduate Teaching——On the Teaching Reform and Practice of "Signal and System" [J]. Talent and Wisdom, 2020, (5): 131.

[14] A. Fu. Strategies for the Construction of Teacher Learning Community [J]. Research and Review on Education, 2019, (9): 54-57.

[15] M. Chang. Changing of Teacher’s Role from the Perspective of the Flipped Classroom [J]. Advances in Social Sciences, 2018, 7(08): 1374-1379. DOI:10.12677/ASS.2018.78203.

[16] W. Sun, X. Zhao, W. Li. The Role Change and Ability Improvement of English Teachers in the Implementation of Flipped classroom [J]. Higher Education Exploration, 2020, (1): 55-58.