Research of BOPPPS Teaching Mode in Digital Signal Processing

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Abstract. This article investigates the implementation and effectiveness of using the BOPPPS teaching model in courses on digital signal processing. Digital Signal Processing is a compulsory course for the Electronic Information Engineering major at our university. There exist numerous issues in the instructional process of this course. To tackle these issues, this article suggests shifting from the traditional teaching approach to employing the BOPPPS teaching model in order to address the limitations of conventional classroom teaching models during the course delivery. Taking this measure in order to improve the quality of classroom teaching, enhance the efficiency of student listening, and thus achieve classroom teaching goals more efficiently.

Keywords: BOPPPS Teaching Mode, Digital Signal Processing, Practical Teaching

1 Introduction

The BOPPPS teaching model is a teaching model that focuses on student-centered teaching philosophy and modularizes the classroom teaching process. ISW [1] has become a widely adopted theoretical pillar in the teacher skills training system in Canada. During the process of teacher training, micro teaching is used for drills, which involve short-term, high-intensity small-scale exercises to allow teachers to re-examine and improve their teaching level, thereby ensuring the achievement of teaching objectives.

Based on the actual teaching situation of the compulsory course digital signal processing in the electronic information engineering major of our school, after continuous in-depth investigation and research, it has been found that there are several problems in the teaching process of the digital signal processing course: firstly, the positioning of teaching objectives is not clear enough; secondly, the teaching content is obscure and difficult to understand, and the formula symbols are complex and numerous; thirdly, the teaching design is not innovative enough.

The article studies the BOPPPS teaching mode and applies it to practical teaching. Through the implementation of BOPPPS teaching mode, the overall course structure is clearly organized, and the classroom teaching content and the thinking are clearer, so students can better grasp the content of this lesson. At the same time, repeatedly testing

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knowledge points can better help students consolidate their knowledge and make their learning more solid. Through repeated familiarization with knowledge points, students have gained a deeper understanding of relatively obscure and difficult concepts such as formulas, symbols, and concepts. This has led to a deeper understanding of the learned content, improving the quality of teaching for teachers and enhancing students' learning efficiency. It has also played a guiding role in other digital signal processing courses in teaching.

2 The Introduction of BOPPPS Teaching Mode

The BOPPPS teaching model was originally created by the Canadian Teacher Skills Training Workshop, this model is inspired by the teacher qualification certification standards [1] of a certain province in Canada. The training mainly adopts a teaching practice based approach in order to cultivate the skills of teachers. The teachers' teaching skills are enhanced and their teaching effectiveness is improved by centralized reinforcement training. At the same time, the improvement of teaching effectiveness is promoted.

The BOPPPS teaching model is based on constructivism and communicative approach, and it is renowned for its high-quality teaching design. It is a closed-loop teaching process model which emphasizes student participation and feedback. The teaching process model it tends to adopt is widely recognized in renowned universities in multiple North American countries [2]. At present, more than 33 countries have introduced and adopted this model, and over 100 universities and industry training institutions have been recommended globally. Practice has proven that the BOPPPS teaching model is an effective teaching method that can stimulate students to actively participate in classroom learning. It is both effective and efficient.

3 The Development Status of Teaching Models in Domestic Universities

At present, the mentorship system such as "mentoring" is widely implemented in domestic universities, which helps to inherit and promote the traditional characteristics of various universities. However, in the process of professionalization development of university teachers, there are challenges posed by factors such as different course natures and teaching characteristics of teachers that may have an impact on the development path. In the field of higher education in our country, it is essential to ensure the healthy and sustainable development of higher education by introducing and constructing teaching models that are suitable for its own characteristics.

Under the promotion of national higher education reform and development, various universities have established many innovative and practical teaching models based on their own characteristics [3]. There are also many excellent teaching models internationally for domestic reference and reference. Classic teaching models such as SIOP in the United States [4] and BOPPPS in Canada [1] have received widespread attention.

Among them, BOPPPS in Canada has successively introduced teacher training in universities and teaching practice links. These modular teaching models have played an important role in teaching practice links, such as teaching quality monitoring, MOOC course construction [5], and professional course teaching research. We conduct in-depth research on the BOPPPS teaching model so as to promote innovation and progress in higher education teaching in China.

4 The Teaching Status of Digital Signal Processing Course

Digital signal processing is a compulsory subject foundation course for undergraduate majors in electronic information. This course is based on the theory of discrete signals and system analysis, and mainly discusses the concepts of discrete-time signals and systems such as linear moving invariant systems, constant coefficient difference equations, signal sampling, Z-transform, discrete-time Fourier transform, as well as discrete Fourier transform and its applications, fast Fourier transform, FFT, infinite length unit impulse response IIR digital filter design, finite length unit impulse response filter design, etc.

One of the key points of the content of digital signal processing course is the frequency domain representation of LSI systems, especially the conversion between time and frequency domains, which involves numerous formulas, complex symbols, and requires a large amount of derivation process that is not easy to understand. There are the following difficulties in the teaching process of this section of the course: First, the positioning of teaching objectives is vague, how to upgrade teaching concepts, how to upgrade teaching ideas, and how to clarify teaching objectives; Second, how to enrich the teaching content and improve the methods. The content is abstract and boring, with numerous formulas, making it difficult for students to understand; Once again, the teaching adopts a silent mode, resulting in poor teacher-student interaction and difficulty in presenting knowledge points vividly and orderly to students.

5 Practical Teaching Application of Digital Signal Processing Course Using BOPPPS Teaching Mode

Taking LSI system frequency domain representation teaching as an example, the BOPPPS teaching mode is applied in the practical teaching of this content. In response to the current problems of vague teaching objectives, complex content formulas, and lack of interactivity in information related professional courses such as digital signal processing, we take LSI system frequency domain representation teaching as an example to illustrate. In order to promote student participatory learning design in a problem driven manner, teaching cases of image processing is introduced. The teaching depth is adjusted based on pre-test results, and the teaching objectives are set combining clear knowledge focus and difficulty points. Analyze students' post test scores, check the achievement of teaching objectives, organize course content, help students summarize

key points, and guide the frequency domain representation content of the LSI system in teaching. The specific operation is shown in figure 1 below:

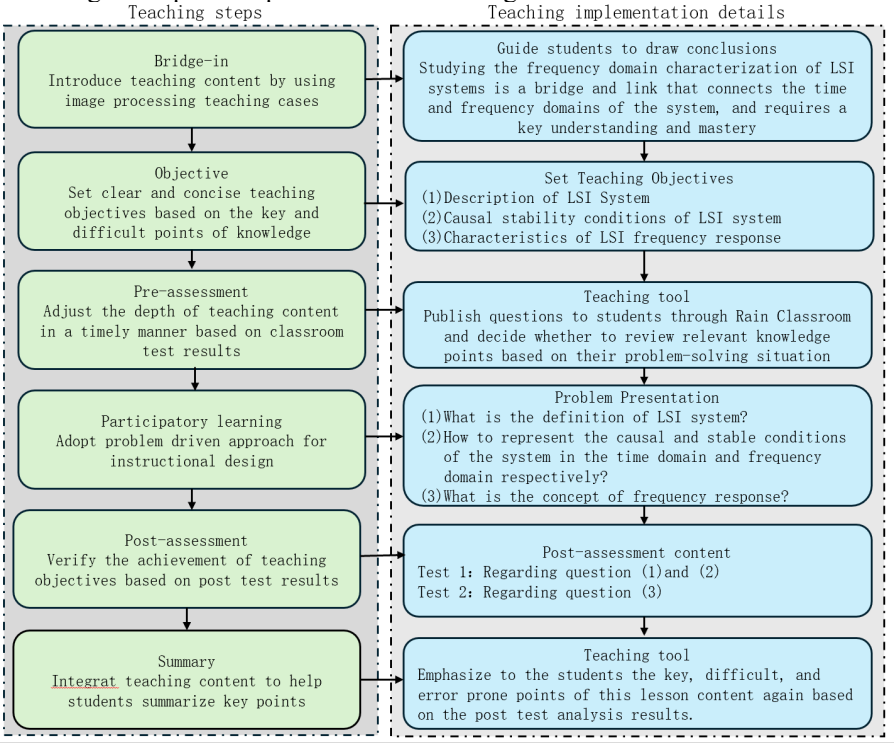

Fig. 1. Implementation block diagram of BOPPPS teaching mode.

In order to attract students' attention and guide them towards the teaching topic of this lesson, the teaching cases of image processing is used in the introduction of the teaching process. In the process of teaching, clear teaching objectives are set during the teaching process and the key and difficult points of knowledge are combined. The depth of teaching content should be adjusted in a timely manner during pre-testing, based on the results of classroom testing, in order to facilitate students' understanding of the key points of this lesson, the significance of teaching implementation, and the cultivation of their abilities. A problem driven approach to teaching design is adopted, and three key questions that run through the teaching process are proposed in the participatory learning teaching process, and conclusions are drawn based on them. All of these above are aims to deepen students' understanding of the learned content, leave a deep impression, and stimulate their interest in learning. The achievement of teaching objectives is verified through the use of classroom test scores in the later stage of teaching evaluation. In the summary stage, the teacher assists students in comprehensively organizing the course content and summarizing the key points. The teaching of frequency domain characteristics of LSI systems has a certain guiding role, and the entire teaching design concept is continuous, rigorous, and gradually promoted. The specific content of each stage is explained in detail in the following text.

That is, when the network is constructed, two sets of mutually independent networks will be established separately, one sets for office automation within the department, and the other sets for connecting to the internet. At the same time, only one hard disk is always working, in this way, the real physical security isolation is achieved.

5.1 Bridge-in

This step is usually done in the first 5 minutes of the whole class. This stage mainly uses teaching methods such as practical classic cases and related video materials, firmly grasping the attention of the whole class, directing the research content of this lesson to students closely related to the teaching content of this lesson, and directing the research content of this lesson to students.

5.2 Objective

Class is begin two minutes after importing, and the class is aims to the course objectives. Teachers should clearly and distinctly inform students of the expected learning outcomes of this lesson, including the key knowledge to be learned and important skills to be mastered in this stage, so as to have a clear understanding.

5.3 Pre-assessment

This step starts from formal classroom teaching, it usually takes 5 minutes and mainly uses questioning to conduct pre class tests on students. The focus of the teaching content will also be adjusted by the teacher in a timely manner based on the test results. All of this is aims to achieve better teaching results.

5.4 Participatory learning

The class focuses on participatory learning, the teacher designs participatory learning in a problem driven manner, allocates about 25 minutes of interactive teaching time for students during the classroom process. To enhance students' understanding and memory of learning content, stimulate their interest in learning, the teacher guides students to think around three key questions throughout the teaching process, and draws corresponding conclusions based on the questions.

5.5 Post-assessment

A post-test session of approximately 6 minutes has been set up in order to assist teachers in evaluating whether students have achieved the predetermined teaching objectives. The teacher uses classroom software to design questions, giving students 2 minutes to answer each question, and then the teacher explains for about 2 minutes.

5.6 Summary

Summary is the last teaching stage of this section, it schedules about 2 minutes. At this stage, the teacher comprehensively sorts out the course content of this lesson and leads the students to review the key points of this lesson. The teacher can point out and emphasize to the students again the errors that are prone to occur in the exercise examination of this lesson based on the results of the post test.

The BOPPPS teaching model is a student-centered teaching approach that focuses on teaching objectives. The BOPPPS model for instructional design can not only help teachers timely understand students' learning situations, adjust teaching objectives and content, but also enhance interaction and communication between teachers and students. All of these above can promote the improvement of class teaching level.

6 Conclusion

The teaching method for frequency domain characterization of LSI systems in the course of digital signal processing is demonstrated using the BOPPPS teaching mode. The reform of this teaching mode is applied to the teaching process of the course digital signal processing in the electronic information engineering major, and is suitable for third year students. It can also be extended to related courses in majors such as safety engineering, robotics engineering, industrial intelligence, and electrical automation in the college.

The traditional teaching mode is broken by reforming this course. The BOPPPS teaching method is introduced in the digital signal processing course, and it focuses on student-centered teaching and it is applied it to ensure the achievement of teaching objectives. At the same time, it make the teaching process interconnected and mutually reinforcing. The BOPPPS teaching method can help teachers grasp students' learning situation, adjust teaching objectives and content, promote teacher-student interaction and improve classroom teaching quality.

The practice of this teaching mode will provide new ideas for reforming the teaching mode and improving the quality of classroom teaching in electronic information engineering majors of applied undergraduate colleges, and has important promotion and application value.

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References

1. Pat P., Russell D.: Instruction Skills Workshop (ISW) Handbook for Participants. The Instruction Skills Workshop International Advisory Committee, Vancouver (2006).
2. Allan J.: Learning outcomes in higher education. Studies in Higher Education, (1):93-108(1996).
3. Mi J., Gao H.: Reform of Teaching Mode with Curriculum Practice Innovation Complementarity. Laboratory Research and Exploration, 34 (2): 167-170 (2015).
4. Jana J.E., Mary Ellen V., Deborah J.S.: Making Content Comprehensible for English Learners: The SIOP Model (4th Edition). Boston, Pearson (2012).
5. Fu Y.X., Ren Y.: Exploration of Introducing MOOCs into Visual Basic Teaching. China Education Technology Equipment, (18): 48-49 (2014).