Application of Interactive Teaching in Digital Signal Processing Courses

WANG Junfeng
School of Computer Science and Technology, Henan Polytechnic University, China, 454000
wangjufeng@hpu.edu.cn

Abstract: Through analyzing the current situation of digital signal processing teaching, the lack of cultivating students’ thinking ability and innovation is serious in the current teaching model. Then, the conception is put forward that an interactive teaching model is used in digital signal processing teaching; the requirements and specific programs are built; the interactive virtual platform and network Lab for digital signal processing learning are developed. Practice Teaching proves that interactive teaching model will help to stimulate students’ interest in learning, and develop students’ practical ability and innovation.

Keywords: Interactive Teaching, Digital Signal Processing, Virtual Teaching Platform

1. Introduction

"Digital Signal Processing" course is a compulsory and major foundation course for communications engineering professional basic course, supported by school key construction curriculum. Students had learned "Signals and Systems" course before studying this course, so that the students should have a certain mastery of the concepts, such as sequence, Z transform, Fourier transform, Spectrum and so on. But the reality was that college enrollment induces a general decline in the level of student-based, so some students had been encountered kinds of difficulties in the "Signals and Systems", which makes them to have a fear of psychological, even lose confidence in learning the "digital signal processing" courses. More, this course involves a lot of mathematical knowledge and abstract concept, so that students have certain difficulties in learning.

The course is characterized by strong theoretical, abstract and high starting point. There are many concepts, such as the linear convolution, periodic convolution and circular convolution easily to be confused with each other. Only to explain on the blackboard, students are often difficult to imagine and understand. Teachers can use material well-produced in multimedia to present the abstract concept to the students in the classroom, which can enhance student understanding. At present, many colleges and universities vigorously promote the multi-media teaching is mainly based on presenting teaching content in PowerPoint, using slide release in the form of the original static or dynamic presentations. But this method only saves time for teachers writing on blackboard, students are largely limited to browse, difficult to hands-on operation and can not be an intuitive understanding of the role of various parameters so that they feel there are castles in the air of the solution, resulting in decreases of the students hands-on ability and innovation ability.

2. Interactive Digital Signal Processing Teaching Requirements for the Teachers

Interactive teaching should be an open space; teachers, teaching methods and means are open, teachers should make full use of curriculum resources, open their own opinions and ideas, the creation of diverse problem situation, cultivating students opening their own research ideas, bold imagination, hands-on experience. Teachers should combine the multimedia teaching with the traditional teaching organically and create a new teaching mode, stimulating student’s interest in learning and developing students creative thinking and practice of innovation.

Therefore, higher requirements are put forward for literacy teachers themselves in the interactive digital signal processing teaching innovation. In the past, the teacher is only a one-way control, which is called “cramming method of teaching” or “the teacher saying counts”. Today, teachers must not only proficient in digital signal processing grant intellectual content, but also must be familiar with interactive
innovative teaching strategies and methods. For example, how to choose the teaching contents, close to the reality of life in the authenticity of digital signal processing experimental tasks, how to design a specific digital signal processing teaching situation, how the process of teaching digital signal processing with students to discuss and timely communication and so on. Currently, many teachers lack combination digital signal processing theory with practice and they also do not understand the needs of society and signal processing applications of technology in the market. Therefore, in the future, schools need to be attention in this regard, encouraging teachers to understand more about the talent requirement for communication engineering, understanding of graduates in a variety of feedback, participating in academic meetings and seminar. At present, many schools teachers focusing on interactive innovative teaching methods have a deeper understanding. For example, in experiments, some teachers take measures to provide the necessary guidance to the students helping to guide students to prefered digital signal processing experiment content, to require students to prep and review, to think independently by students, to discuss the design of programs, access to vast amounts of data, to put forward some theoretical basis or simulate by means of computer simulation software, to select the experimental method, to observe the contents of the establishment and practical results. Finally, the student analyzes and discusses the experimental results, from which inspiration and ability of the engineering application is improved effectively.

3. Interactive Digital Signal Processing Teaching Program

3.1 Changes in teaching methods to improve classroom teaching.
Combination of introduction and correlation. When students are in contact with a new class, they will feel curious and strange, and even some students will rise to think that this course is very hard. To shift this kind of psychological into an active one, the introduction of this class is very important the teachers. It has been reflected in the students that the signal courses is very difficult to learn. In order to exclude the students fear and misunderstanding psychological, teachers need to use multimedia presentations courseware to introduce this course takes the roles in people's production and life. For example, the most vivid example is the mobile phones widespread used, introducing the students to know that the digital signal processing technology is embedded inside. Because of digital signal processing technology developing, the mobile phones become smaller and smaller size, and the sound quality is getting better. So that students feel that they have learned something by them side, on the people's lives, rather than remote touch of reach. The so-called correlation method is to associate the knowledge with the curriculum and other courses, letting the students know why to learn this course and what purpose. Therefore, teachers should infiltrate the correlated course information (such as speech signal processing and image processing) to the students in a proper manner, and present their current state of development and the results achieved to students through the demonstration of modern teaching methods so that they have a clear learning objectives. Of course, it requires that teachers in the teaching process can not conform to convention, be access to new knowledge, new technologies, be continuous learning and improving ability of teaching and learning.

Proper seminar-style teaching, that is, Seminar. Seminar first appears in university in Germany, now, the generation and application extend to the whole world. In the Seminar, the students are the main, teachers and students on an equal footing. Although establishing the subject of discussion and ask questions, the teacher's role has changed. Teachers are no longer simply imparting knowledge, but an inspiration to academic discussion and research for students. In view of the theme for the discussion, teachers and students can express different opinions. In the process of research and discussion, what students have learned is sublimated, but also the desire for knowledge is inspired.

3.2 The curriculum design practice and subjects research.
According to the basic theory, the curriculum design practice is carried out based on the existing experimental conditions of schools. Students can participate in project-based research under the guidance of teachers, training student’s practical ability and innovation. Type of research topics include
he following aspects: subjects with certain depth and novel signal processing content in the learning process; subjects inspired by participating in signal processing related to academic lectures; new topic access to information by Internet; studies and small issues given by teachers for undergraduate.

3.3 Development of graphical interactive digital signal processing teaching experiment platform

A new teaching and experiment platform for digital signal processing courses is developed based on virtual instrument technology with limited investment. It can be used to design the experiments and classroom demonstration program for teachers and to make comprehensive experiments for students, which will fundamentally change the long-term situation of experiment content lagging behind technological development. It stimulates students to enthusiasm for learning, achieving the training objectives of creative thinking and innovation ability of students. Moreover, it drives the improvement of teaching philosophy, methods and means for the teachers.

This virtual platform is divided into modules, including the signal time-domain analysis, frequency domain analysis, digital filter three base functional blocks and virtual spectrum analyzer system and AM modulation and demodulation experiment two comprehensive functional blocks. The platform is presented in graphical interface; in which signal parameter is designed as buttons easy to change and results of signal processing is displayed in graph compared with origin signal. Teachers can optimize experiment modules; modify parameters conveniently and accurately according to the effects of theory and experiments.

3.4 Establishment of a network Virtual Laboratory based on virtual instrument

Experiments can be carried out without restrictions of time, site and number of times, with the full realization of instruments and data sharing. Student’s learning is changed from passive learning to the principal part. This mode realizes truly personalized teaching and settles the thorny problem of the shortage of teaching resources. In this regard, remote web-based experiment and teaching system is developed by making full use of remote monitoring and control technologies of the virtual instrument technology. Results in the virtual laboratory will be stored in the server's database to enable teachers to assess problems and feedback to students.

4. Conclusion

Through interactive teaching applications in "Digital Signal Processing" course in recent two years, teachers have a certain depth and breadth of knowledge and timely track the frontier technology developments. After understanding and digestion, teachers introduce the most new technology to the lesson teaching. Students generate a strong interest in digital signal processing under the guidance of teacher. They can verify the theory courses in graphic interactive experiment platform and deepen understanding of the practicability of digital signal processing through topics discussion and project design.

References