Discussion on Bilingual Teaching of Digital Signal Processing Course in Major Evaluation—Take Anhui Xinhua University as an Example

Fan ZHANG1,a, Ning-Xin SU2,b and Ting ZHU2,c

1Science and Technology Research Office, Anhui Xinhua University, Hefei, Anhui, China
2Electronic Communication Engineering School, Anhui Xinhua University, Hefei, Anhui, China
asa0527@163.com, b47858998@qq.com, c992350541@qq.com

Keywords: Digital Signal Processing; Bilingual teaching; Syllabus; Teaching organization; Curriculum assessment and evaluation.

Abstract. In this paper, based on the practice of implementing bilingual teaching in Digital Signal Processing Course of Anhui Xinhua University, the project team systematically studied, analyzed and summarized the necessity and feasibility of bilingual teaching, the formulation of teaching program and the implementation of teaching organization, and the assessment and evaluation of courses. Through the concrete actual effect testing, the result is pretty well, which has the extensibility.

Introduction

Digital Signal Processing Course is an important basic course of communication engineering major, which occupies an important position in major evaluation. In 2017, the project team applied for the approval of the University-level Quality Engineering project of Anhui Xinhua University (Grant No. 2017sykcx01), which involved the bilingual teaching demonstration course "Digital Signal Processing." Based on the practice of implementing bilingual teaching in Digital Signal Processing Course of Anhui Xinhua University, the project team systematically discussed and summarized the necessity and feasibility analysis of bilingual teaching, the formulation of teaching program and the implementation of teaching organization, and the assessment and evaluation of courses.

The Necessity and Feasibility of Bilingual Teaching

The bilingual teaching of Digital Signal Processing Course could make significant progress in the goal of method ability, professional ability and social ability. It enabled students to learn to study by themselves, collect and retrieve information, look up technical materials, select various instruments in the process of digital signal processing, and have the basic ability to design digital filters. At the same time, it could cultivate students to establish the spirit of unity and cooperation, develop the courage to innovate work style, broaden the thinking scope in product development.

Analysis of Necessity

In order to meet the needs of professional development, improve the teaching level, and promote the quality education focusing on the cultivation of innovative spirit, innovate ability and practical ability, our school has been taking Digital Signal Processing Course as the main major course. However, with the continuous development of the times and the ever-changing technology, it was necessary to further optimize this major main course in order to improve the teaching quality. As colleges and universities to cultivate talents, it has become a common understanding and development trend to adopt classic English teaching materials and carry out bilingual teaching. The Ministry of Education proposed suggestions from Opinions on Strengthening Undergraduate Teaching In Institutions of Higher Learning and Improving Teaching Quality, “...in order to adapt to the challenges of economic globalization and scientific and technological revolution, undergraduate...
education should create conditions for the using of English and other foreign languages in public and specialized courses." The Ministry of Education has listed bilingual teaching as one of the contents to evaluate the teaching level of colleges and universities. So bilingual teaching was a hot topic in teaching reform in China.

At present, a series of important activities such as major evaluation, discipline application and professional master application are about to be launched. *Digital Signal Processing*, as an important basic course of communication engineering major, has become the best course for bilingual teaching. Through the research and practicing of bilingual teaching, it could improve students' reading and understanding of English literature, cultivate applied talents, meet the social demand for talents, which could also mine the development potential of the electronic information professional teaching, made the professional education and the market demand better. It could be conducive to improve graduates employment ability to adapt, also be helpful to achieve the education philosophy notion of "technology first."

**Feasibility Analysis**

Our teaching object was undergraduate students of communication engineering major in the third year from Anhui Xinhua University. In order to implement bilingual teaching better, we have carried on the feasibility analysis of various aspects.

**Feasibility Analysis of English Proficiency.** At the beginning of this course, most students have passed CET-4 (College English Test Band 4) and achieved a good level of English. In the previous course "Signal and System," most of the professional terms related to the course have been contacted, so it reduced the difficulty of switching between Chinese and English professional terms when learning the new course. Therefore, bilingual teaching for them was completely feasible.

**The Feasibility Analysis of Bilingual Teaching System Research.** In terms of teaching methods and means, it was necessary to fully stimulate students’ initiative and enthusiasm in learning, turn to the teaching content, and try to establish a bilingual teaching program and system consistent with the students' level in our school. From previous experience, the teaching system of *Digital Signal Processing* in our university was complete, with high teaching quality and complete experimental system, so it was also possible to establish a bilingual teaching system.

**The Feasibility Analysis of Textbook Selection.** Textbook, as the carrier of teaching content, played an important role in guaranteeing teaching effect. One of the important significance of adopting bilingual teaching was to absorb advanced materials from foreign textbooks, learn from foreign scientists to carry out scientific research, participate in engineering practice and face the market economy, and cultivate students' innovative spirit. Our textbooks mainly used the classic Chinese textbooks of Higher Education Press (Zhen-yang WU) and the classic English textbooks of Electronic Industry Press (Kun-bao CAI, and Richard G.Lyons). The quality and influence of these textbooks were obvious, which would be of great benefit to the bilingual teaching of *Digital Signal Processing*. We also planned to improve the compilation of English lecture notes in the teaching process, so as to lay a solid foundation for the future compilation of English textbooks.

**Syllabus Formulation and Implementation of Teaching Organization**

Since it was the first time for the project team to carry out bilingual teaching of *Digital Signal Processing*, according to the basic teaching requirements of *Digital Signal Processing* formulated by the Ministry of Education, the teaching syllabus of regular and experimental courses must be revised accordingly. In view of bilingual teaching, the project team explored the revision of the teaching syllabus of normal and experimental courses before the implementation of the teaching process.

**Syllabus Formulation**

*Digital Signal Processing* (2nd edition) (edited by Kun-bao CAI) was selected as our reference textbook in English, which was published by Electronic Industry Press in 2011. This book systematically demonstrated the basic theory, basic analysis and design method, basic algorithm and processing technology of signal and system analysis, and system design involved in digital signal
processing. *Digital Signal Processing* (2nd edition) (English version), totally consist of 10 chapters, and whose main contents include basic concepts of discrete time signal and system, the transform domain of discrete time signal and system analysis. The whole system included the Z transform and Discrete Time Fourier transform, continuous time signal sampling and reconstruction, Discrete Fourier Transform (including FFT) and its fast algorithm to realize the basic structure of the digital filter, design principle and basic design method of IIR and FIR digital filter, finite word length effect in digital signal processing, multiple sampling rate of digital signal processing. *Digital Signal Processing* (2nd edition) (English version) was equipped with multimedia courseware, English syllabus, exercise guide and experiment manual. The details are shown in Table 1.

**Table 1. Syllabus for Main Courses and Laboratory Courses.**

| Main Courses Syllabus                                           | Experimental Courses Syllabus                  |
|-----------------------------------------------------------------|------------------------------------------------|
| (1) Introduction                                                | (1) Discrete-Time Signals and Systems          |
| (2) Discrete-Time Signals and Systems                           | (2) The Discrete Fourier Transform             |
| (3) Transform-Domain Analysis of Discrete-Time Signals and Systems | (3) Design of IIR Digital Filters              |
| (4) The Discrete Fourier Transform                              | (4) Design of FIR Digital Filters              |
| (5) Fast Fourier Transform Algorithms                           |                                                |
| (6) Digital Filter Structures                                   |                                                |
| (7) Design Techniques of Digital IIR Filters                    |                                                |
| (8) Design of FIR Digital Filters                               |                                                |

*Digital Signal Processing* (2nd edition) (English version) could be used as a bilingual teaching material for undergraduate *Digital Signal Processing* Course in electronics and communications majors, or as a reference book for English teaching in Chinese, as well as for engineers and technicians engaged in digital signal processing, which is especially suitable for teachers who initially teach *Digital Signal Processing* Course in both Chinese and English.

"*Digital Signal Processing* (2nd edition) (English version)" theoretical system was rigorous. And the knowledge structure was reasonable, clear, distinct, whose narrative was concise. It had necessary electronic multimedia courseware, English version of syllabus, problem and laboratory manual, whose contents and depth conforms to China's national conditions. So it was particularly suitable for both Chinese and English bilingual teaching.

**Teaching Organization and Implementation**

Anhui Xinhua University has set up a supporting laboratory while offered bilingual teaching of this course. According to the spirit of relevant documents and curriculum requirements of the school, the teachers of the course group had improved various teaching documents, including the curriculum syllabus, experimental syllabus and experimental instruction. The teaching goal of cultivating students' practical innovation and application ability was established, and the teaching system of "cognitive experiment, principle experiment, comprehensive experiment, innovative experiment and progressive experiment" was formed. At the same time, on the basis of the original construction, the laboratory has updated its equipment and increased the number of experimental sets.

In the process of theoretical teaching, the modern educational concept was continuously injected into the course teaching. And the advanced teaching means including multimedia teaching were tried hard to stimulate students' learning enthusiasm. The electronic teaching plan and lecture notes of this course were compiled and perfected, and the multimedia courseware of this course was completed.

In terms of the construction of the teaching staff, it further improved the knowledge structure, age structure and educational background structure of the teaching staff. At the same time, it paid attention to improving the scientific research and teaching research level of teachers, and improving their comprehensive ability. Combined with the characteristics of private colleges and universities, it has adopted the mode of "introduction, cultivation and improvement" to carry out the planned and targeted cultivation.

The teachers of the course group always focus on improving the quality of education and teaching and try their best to combine teaching with scientific research. On the one hand, teachers could be
trained and improved through scientific research activities. On the other hand, scientific research results could also be enriched in teaching content, and scientific research could be used to promote the improvement of teaching quality and the updating of knowledge structure, which fully reflected the characteristics of application-oriented undergraduate.

At present, the teaching mode of this course was mainly based on multimedia courseware teaching, with appropriate assistance of physical display, blackboard writing, etc. During the teaching in cooperation with experiments, it has laid a good foundation for the further development of the course.

**Assessment and Evaluation of Digital Signal Processing Course**

The course outline of *Digital Signal Processing* was made according to the teaching plan of communication engineering undergraduate major. The contents listed mainly emphasize the basic knowledge of digital signal processing and its application skills. The content showed the scope and depth of teaching, and the specific teaching arrangement should be carried out according to the specific teaching plan. Specific curriculum assessment and evaluation programs are shown in Table 2.

| Performance Constitution | Performance Subitem | Respective Details |
|--------------------------|---------------------|-------------------|
| The final total score=Usual performance score×30%+Final examination score×70% | Usual performance score | Attendance (All Students) At least 8 times of comprehensive evaluation, and the highest point is 20. Excellent point-18, Good point-16, Medium point-14, Passing point-12. |
|  | | Asking questions (All Students) At least 2 times of comprehensive evaluation, and the highest point is 20. Excellent point-18, Good point-16, Medium point-14, Passing point-12. |
|  | | Homework (All Students) At least 5 times of comprehensive evaluation, and the highest point is 20. Excellent point-18, Good point-16, Medium point-14, Passing point-12. |
|  | | Thesis (All Students) At least 1 time of comprehensive evaluation, and the highest point is 20. Excellent point-18, Good point-16, Medium point-14, Passing point-12. |
|  | | Experimentation (All Students) At least 6 times of comprehensive evaluation, and the highest point is 20. Excellent point-18, Good point-16, Medium point-14, Passing point-12. |
|  | | Final examination score | Final Examination (All Students) At least 1 time of comprehensive evaluation, and the highest point is 100. Excellent point-90, Good point-80, Medium point-70, Passing point-60. |
|  | | Excellent: 90-100 Good: 80-89 Medium: 70-79 Passing: 60-69 Failing: 0-59 | |
|  | | Excellent: 90-100 Good: 80-89 Medium: 70-79 Passing: 60-69 Failing: 0-89 |
|  | Final examination score | Excellent: 90-100 Good: 80-89 Medium: 70-79 Passing: 60-69 Failing: 0-89 |

Description: This course examination was the examination course. According to the teaching progress, the final total score = Usual performance score × 30% + Final examination score × 70%. Among them, the usual performance score included at least 8 times of Attendance, 2 times of Asking questions, 5 times of Homework, 1 time of Thesis, 6 times of Experimentation. The final examination would include one quiz.

**Specific Calculation Methods of Usual Performance Score**

20 points of Attendance, i.e., at least 8 times, floating around points according to the situation. Excellent point-18, Good point-16, Medium point-14, Passing point-12.
20 points of Asking questions, i.e., at least 2 times, depending on the situation around the points. Excellent point-18, Good point-16, Medium point-14, Passing point-12.

20 points of Homework, i.e., at least 5 times, depending on the situation around the points. Excellent point-18, Good point-16, Medium point-14, Passing point-12.

20 points of Thesis, i.e., at least 1 time, floating around the score points according to the situation. Excellent point-18, Good point-16, Medium point-14, Passing point-12.

20 points of Experiment, i.e., at least 6 times, floating around the score point according to the situation. Excellent point-18, Good point-16, Medium point-14, Passing point-12.

The details are shown in Table 3.

Table 3. Specific Calculation Method of Usual Performance Score.

| Project         | Highest Score | Excellent Point | Good Point | Medium Point | Passing Point | Lowest Point |
|-----------------|---------------|-----------------|------------|--------------|---------------|--------------|
| Attendance      | 20            | 18              | 16         | 14           | 12            | 0            |
| Asking questions| 20            | 18              | 16         | 14           | 12            | 0            |
| Homework        | 20            | 18              | 16         | 14           | 12            | 0            |
| Thesis          | 40            | 36              | 32         | 28           | 24            | 0            |
| Subtotal        | 100           | 90              | 80         | 70           | 60            | 0            |

Composite Calculation Standard

According to each part of the usual record (Excellent, Good, Medium, Passing, Failing), it carried out the mark conversion. The specific details are shown as follows.

Excellent: 90-100; Good: 80-89; Medium: 70-79; Passing: 60-69; Failing: 0-59.

The adoption of the above-mentioned performance assessment and evaluation scheme was conducive to students' attention to every detail of knowledge, attendance, questions and homework, which laid a good foundation for papers and experiments, and constantly paid attention to the progress of courses. So it continuously improves the teaching effect of bilingual courses.

Conclusion

After more than one year's efforts, the project team has fully aroused the enthusiasm and initiative of all students to learn this course. In accordance with the teaching content, the bilingual teaching program and system consistent with the students' level in our school has been established preliminarily. Due to the adoption of the all-round English model (including homework, papers, papers, etc.), students' acceptance of bilingual teaching has been improved greatly. At the same time, mastering the knowledge of the degree of firmness, English understanding of professional literature and other aspects all had a good effect.

After trial and error, the project team has preliminarily carried out the practice and exploration of bilingual teaching of Digital Signal Processing, and achieved good results. It was of great significance for the evaluation of communication engineering major, which has good reproducibility and certain extensibility.

Acknowledgement

This research was financially supported by the Quality Engineering Project at Anhui Provincial level (Grant No. 2017jyxm1232, Grant No. 2016jxtd055), the Quality Engineering Project at Anhui Xinhua University level (Grant No. 2017sykcx01), Key Construction Discipline Project at College Level of Anhui Xinhua University (Grant No. zdxx201702), Institute Project at College Level of Anhui Xinhua University (Grant No. yjs201706), and the Ninth Batch of Young and Middle-aged "Academic Leaders" Training Objects Project of Anhui Xinhua University (Grant No. 2018xxk14).

432
References

[1] Yong-hong Kuo and Guang-ming Shi. Study on Bilingual Teaching Practice of Digital Signal Processing [J]. Journal of Peking University (Philosophy and Social Sciences), 2007, (5): 87-88.

[2] Yi-bin Yu and Jun-ying Gan. Bilingual Teaching of Digital Signal Processing [J]. China Electric Power Education, 2010, (32): 105-107.

[3] Ling Huang, Jin-hua Wang and Jian-hai Li. Research on Problems and Countermeasures in Bilingual Teaching in Colleges and Universities—A Case Study of "Digital Signal Processing" Course under the Background of New Engineering Construction [J]. Gansu Education, 2018, (24): 84-85.

[4] Zhi-gang Ren, Ba-jin Li, Ke-qilao Meng, et al. Initial Research and Practice on Bilingual Teaching Mode of Digital Signal Processing [J]. Journal of EEE, 2005, 27 (6): 16-18.

[5] Hai-qing Wang, Zhao Zhao and Ya-Lin Gu. Bilingual Teaching Practice of "Digital Signal Processing" [J]. China Electronics Education, 2009, (2): 52-55+59.

[6] Hai-bo Liu and Qun-fang Tang. Bilingual Teaching Construction and Research of Digital Signal Processing Course for Undergraduates [J]. Electronics World, 2018, (3): 53-55.

[7] Ding-li Yang and Li-qun Huang Fu. Teaching Exploration of Bilingual Course of "Digital Signal Processing" [J]. China Electronics Education, 2012, (32): 53-54.

[8] Wei-min Su and Hong Gu. Experience in Bilingual Teaching of Digital Signal Processing [J]. Meitan Higher Education, 2003, 21 (6): 119.