

# Exploration of Classroom Instruction Method for “Microcomputer Principle and Interface Technology”

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**Abstract**—The teaching method of university is not only the way of interaction between teachers and students in teaching activities, but also a special method of cognition. Combined with the characteristics of the course of “Microcomputer Principle and Interface Technology”(MPIT), the reformation of classroom Instruction will focus on developing the students’ ability of active exploration and discovery. Lots of reform teaching methods, such as heuristic teaching, interactive teaching, flexible teaching, matching generality with individuality and so on will be presented to manifest their merits. Moreover, each reform method can be illustrated in the specific chapter of MPIT with an example to make full use of its advantages. In this way, the teacher and the students can inspire and help mutually through the effective interaction between them, which will contribute to the improvement of the teaching and learning quality ultimately.

**Keywords**—classroom instruction; heuristic teaching; interactive teaching; flexible teaching; generality with individuality

## I. INTRODUCTION

As the professional basic course for electrical engineering and related majors, “Microcomputer Principle and Interface Technology” (MPIT) has a great influence on the students’ study of follow-up professional core curriculum and engineering practice. The course includes microcomputer principle, assembly language and interface technology. The instruction of this course consists of classroom theoretical teaching and experimental teaching. The content of the classroom theoretical teaching is abstract, theoretical, hierarchical and modular, so it’s difficult to understand the key knowledge points, even if it can guide the experiment, the main reasons are as follows:

Firstly, the characteristics of classroom theoretical teaching is massive knowledge points and abstract content, which make many students feel dull in the learning process and lost confidence, patience and interest about the course. Based on the 8086CPU and the outside interfaces, the course belongs to the category of hardware [1]. Most contents of the course, such as architecture of chip, storage of information, addressing and executing of instruction and so on, are abstract to the students, who will feel boring and reduce their interest, initiative and enthusiasm in learning.

In the course of study, the students must not only master the internal structure and working principle of the microcomputer, but also master the assembly language programming. Once the students completely understand the relationship between the hardware (microcomputer) and the software (assembly language), they can truly understand and master the content of this course.

Secondly, the traditional instruction method is based on the classroom instruction of the teacher, which instill all knowledge into the students’ mind. The teacher narrates the general principles of the microcomputer according to the teaching materials, and the students woodenly listen and learn by rote. In this way, the principle and system of the microcomputer are obscure for understanding. For example, the assembly language which is oriented to machine is closely related to the hardware of the machine, and the user can carry on direct and accurate operation to the hardware by using the assembly language. There are two typical problems in learning assembly language. First, the learning of the assembly language is closely related to the hardware component and the working principle of the microcomputer. If a student can’t understand the working principle of the microcomputer and just has a superficial knowledge of the assembly language, he will not combine the learning of assembly language with the hardware system effectively. Second, compared with the normal language which the students contact frequently, like C language, assembly language instruction system is more complex to understand and master.

Therefore, knowledge is not infused to students by the teacher, but can be constructed by the students themselves. The teacher must guide the students to construct knowledge actively, arouse the enthusiasm of students to learn. So, the teacher must try to explore a variety of teaching methods, such as the heuristic, interactive, flexible, participatory teaching methods to guide the students to active exploration and discovery.

The particularity of the method of university teaching is the combination of teaching method and learning method. Therefore, in the instruction of MPIT, it’s important to take effective teaching method in class to ensure the students can understand and master the principle of the microcomputer (hardware system) at first, and then learn the assembly

language (software system) based on the chip, accomplish the study and application of external interface technology through the comprehensive understanding of hardware and software system knowledge at last.

## II. REFORM IDEAS

In the traditional classroom instruction, the teaching method which takes the teacher as the center to instill the knowledge to the students in the whole lesson is usually unsatisfied [2] [3]. Based on the people-oriented principle, that is, the students as the main body, it is more important to explore and implement a variety of teaching forms and take full advantage of these forms to cultivate students' comprehensive application abilities [4]. The basic features of modern university teaching methods include purpose and hierarchy, diversity and flexibility, time and stage, instrumental and means.

The reform ideal of the instruction method of MPIT is that the teacher takes a variety of teaching methods to improve the teaching effect by promoting students to participate in the classroom teaching, stimulating students' learning enthusiasm and interest, cultivating the habit of spontaneous learning. The teaching forms are as follows:

### A. Heuristic Teaching

Classroom teaching is the main form of teaching in colleges and universities. The traditional classroom teaching, to a great extent, is the teaching method, which emphasizes that the teacher lectures and instills knowledge in the students. It is obviously not enough to cultivate the students' subjectivity and creativity [5]. The key to solving the problem lies in transforming the classroom teaching by the one-way output into a two-way exchange and adopting the heuristic teaching. In the heuristic teaching method, the teacher not only teaches the basic concepts and principles of the lesson to the students, but also teaches the various learning experiences and methods to the students through the teacher's inspiration. Therefore, it can guide and inspire the students to explore independently, and develop the students' abilities to think and study independently.

### B. Interactive Teaching

Classroom teaching is the activity that teachers and students participate in, and its effect is the result of the positive interaction between teachers and students. It's necessary to break the classroom teaching mode of the teachers' playing a monodrama, encourage students to participate in teaching. If the classroom teaching play down the students' consciousness of participation, a significant wall will be built between the teacher and the students, which hinders the training of the students' independent thinking and innovative thinking, hinders the communication and discussion between teachers and students, and restricts the students' learning ideas and vision [6]. Therefore, it is important to encourage students to take part in the classroom teaching, and to strengthen the interaction between the teacher and students. In this way, the teacher and students can inspire each other in the process of teaching, benefit from each other, and make progress together.

### C. Flexible Teaching

Traditional classroom teaching often takes a fixed pattern, which emphasizes the steps of the teaching process, the integrity of teaching content, and standard of teaching method.

Traditional classroom teaching takes the textbook as the center, refine and quantify the lecture program and content [7]. As a result, the teacher carries out mechanical teaching which not only restricts the teaching style of the teacher, but also limits the cultivation of students' personality. Therefore, it's necessary to adopt flexible teaching method to transform the students' passive reception into the students' positive to obtain. Teachers should not only know many effective methods of teaching, but also should consider and decide carefully when, what kind of teaching situation, how to adopt effective teaching methods, to realize flexible teaching.

### D. Matching Generality with Individuality

University education should not only meet the needs of the community to the talent (generality), but also promote the student's individual character development (individuality) [8]. For a long time, university classroom teaching pays more attention to the social needs and ignores the cultivation of personal qualities, which hinders the development of students' personality. Therefore, it's important to develop the generality of education and the student's personality.

Therefore, the teachers must choose suitable teaching methods for students according to the students' knowledge base, interest, learning motivation and cognitive style differences. Moreover, teachers must timely adjust the innovation teaching method to accommodate the change of the teaching context, teaching process.

### E. Combination of Multimedia and Blackboard-writing

With the development of Internet technology, the teaching mode of multimedia is produced. Multimedia teaching using sound, image, animation, and other means, to present vivid image of the book knowledge in a dynamic form to the students. However, there are also some shortcomings of the multimedia, such as the derivation process is too fast, the content is too multifarious and disorderly and so on. So it's necessary to combine the multimedia with the blackboard-writing, which has the advantage of taking on clear derivation process, providing students with the opportunity to participate in the teaching process, deepening students' impression and so on.

From what has been discussed above, the advantage of each reform methods can be demonstrated in the TABLE I As displayed in the table 1, in the modern classroom instruction, all kinds of teaching methods must to be adopted to promote the quality of teaching and learning. In general, the reform methods are characterized by the teaching students to learn by themselves, teaching and learning between teachers and students, and cultivating the students' abilities of autonomy, cooperation, research and innovation. In the following section, the mentioned methods will be effectively applied in the curriculum MPIT, which is a professional basic course for electrical engineering and related majors.

**TABLE I. THE ADVANTAGE OF EACH METHOD**

<b>Method</b>	<b>advantage</b>
heuristic teaching	teach learning experiences and methods to the students develop the students' abilities to think and study independently
Interactive Teaching	encourage students to take part in the classroom teaching strengthen the interaction between the teacher and students
Flexible Teaching	transform the students' passive reception into the students' positive to obtain
Generality with Individuality	meet the needs of the community to the talent promote the student's individual character development
Combination of teaching tools	take on clear derivation process provide students with the opportunity to participate in deepen students' impression

### III. REFORM METHODS AND MEASURES

Reinforcing the professional basis as the goal, various teaching methods are used to mobilize the enthusiasm and creativity of students in the process of teaching.

Firstly, in the heuristic teaching method, the teacher cultivates students' abilities to find and solve problems independently, pays attention to the training of students' learning method, and lead students to acquire knowledge on their own [9]. Through the teacher's lecture, the learning methods and ideas are imparted to the students to arouse their subject consciousness. Once the students master the scientific learning method, they will inspire thinking, carry out autonomous learning, improve self-learning abilities and application abilities, and finally become the "master of learning".

For instance, in the section of addressing mode of the microcomputer, after explaining the basic meaning of register addressing mode, register indirect addressing mode, and register relative addressing mode, the teacher can ask the students: What is the difference among the three modes about the register? Furthermore, based on the register addressing mode and register relative addressing mode, the teacher requires the students to think that what is the difference between the two modes? How to embody the concept of "relative"? In this way, the students can analyze the differences between the concepts through an exploratory thinking, and then they will master the analytical method for similar situation.

Secondly, in the interactive teaching method, encouraging students participate in classroom teaching and placing the students in the main position. Based on the students' group discussion and study, accompanied by the ways of situational hypothesis, problem discussion, and work together as a team and so on, the students can develop the good habit of actively learning by their positive contacting and understanding of new knowledge.

Taking six working modes of the timer/counter 8253 as an example, the teacher can arrange the students to discuss to find out typical characteristics and application situations of each mode in groups. In this way, the students will deeply understand the difference among various working modes and be more familiar with the modes' specific applications.

Thirdly, in the flexible teaching method, the teacher must break a variety of restrictions to divide the knowledge points into the basis points, key points, difficult points and students' interest points, etc.. In term of this division, the teacher can allocate different degree of teaching to each point. Facing the simple content, the teacher can omit it and let the students study on their own. Facing the applied content, the teacher can adopt the method of live demonstration to make the students get the perceptual knowledge and the learning enthusiasm.

The content of the course consists of the knowledge of software and hardware, which is widely used in the actual production and life. Take parallel interface chip 8255 as an example, on the one hand, a port acts as the input port to read the external switch quantity to 8255, which sends to 8086 CPU for processing. On the other hand, B port acts as the output port, which outputs the processed switch quantity to the external LED (Light Emitting Diode) to display. When the teacher lectures on the particular subject, besides the principles of 8255's construction and programming, she/he can use the experimental box to show the processing procedure and the results. In this way, the students can deepen the understanding of the typical applications in the 8086CPU system of 8255, that is, the students can fully understand the control effect of 8086 CPU on the 8255 chip and the effect of 8255's port expansion to stimulate their interest in project development.

Fourthly, in the method of matching generality with individuality, the teacher can stimulate the students' enthusiasm for learning, cultivate the students' self-consciousness and innovation spirit, encourage the students to raise questions, think openly, and display individuality.

Introducing the interface technology, the teachers can present the following questions: How does the system realize the data transmission between the microcomputer and the external equipment? Before lecture on the serial communication interface chip 8251, the teachers can ask the students: What is the serial communication in daily life? So it makes the students continue to learn with his questions.

Finally, multimedia not only improves the efficiency of the classroom, but also makes the abstract knowledge for visualization, which helps the students to understand and remember the content of learning [10]. In addition, blackboard-writing pays attention to the details and steps of solving the problem; it can deepen students' understanding of the details by the demonstration of the teachers. The teachers can use FLASH to show the principle of CPU, which can stimulate the coordinate work among various components. In the section of the programming for interface, the teacher can make full use of animation to demonstrate the operating process of the instructions of IN and OUT. However, the program design is suitable for writing on the blackboard to give the students some space to think about.

**TABLE II. THE APPLICATION OF METHODS**

Method	Chapters of the course	Purpose	Realization Means
Heuristic teaching	Addressing mode of the microcomputer	the students can analyze the differences between the concepts through an exploratory thinking	Put questions to students continually
Interactive Teaching	Six working modes of the timer/counter 8253	Develop the good habit of actively learning	Students' group discussion and study,
Flexible Teaching	Parallel interface chip 8255	Stimulate the students' interest in project development	live demonstration
Generality with Individuality	Interface technology, the serial communication interface chip 8251	Cultivate the students' self-consciousness and innovation spirit	learn with his own questions
Combination of teaching tools	the principle of CPU, operating process of the instructions of IN and OUT	improves the efficiency of the classroom, makes the abstract knowledge for visualization	blackboard-writing, Flash, Animation

Therefore, each reform method can be applied in the specific chapter of the course to make full use of their advantages. The vivid and effective combination is displayed in the TABLE II.

#### IV. CONCLUSIONS

With the developing of the information era, information technology is widely used in the classroom, the teaching methods of instruction present significant changes which will further integrate the nature of the subject and the purpose of teaching, and analyze the characteristics of instruction teaching from the relationship between teaching and learning.

The reform of classroom instruction method for MPIT encourages the students to take part in the classroom teaching,

which makes the students become more active, and lets the students become the main body. In the teaching process, the teacher can fully mobilize the initiative of students to enrich the thinking process, and cultivate their personality. Through the advanced teaching methods, the dull and difficult content becomes vivid and easy knowledge to learn. Little by little, it can strengthen the students' creativity, sense of achievement and satisfaction. Ultimately, the students' abilities to develop software and hardware development can be enhanced by the cultivation of the learning interest, which will lay a solid foundation for future study and work.

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