

Teaching Reform of Semiconductor Materials and Devices Based on Multimedia Technology

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Abstract: In order to meet the needs of personnel training in new strategic industries in China and to train applied and research-oriented talents more in line with the needs of development, the course "Semiconductor Materials and Devices" is offered to improve the ability of university students to combine theory with application, including the contents of semiconductor materials, optoelectronic devices and microelectronic devices. Combining with the teaching practice, the teaching reform of semiconductor materials and devices based on multimedia technology is studied through the consideration and practice of the purpose and significance of the course, the construction of teaching content and teaching methods. The purpose is to improve students' enthusiasm and initiative in learning, stimulate students' interest in learning this course, and make students fully understand the theory and principle of optoelectronic devices and microelectronic devices, so as to improve the quality of teaching. Reasonable selection and application of modern teaching media in multimedia teaching can truly realize the interaction between teaching and teachers and students, and achieve the optimal teaching effect.

1. Introduction

Semiconductor industry has become a strategic industry related to national economy and national security. In the past sixty or seventy years, with the rapid development of semiconductor science and related industries and knowledge updating, the basic education of semiconductor physics has put forward new and higher requirements. In the undergraduate teaching of semiconductor physics and devices, it is found that the course has strong applicability [1-2]. When we talk about how semiconductor devices play a role in integrated circuit applications, the knowledge is very abstract. Students can only understand it by imagination, without intuitive feelings, and the classroom effect is very poor. The traditional teaching mode can no longer meet the needs of personnel training and the development of semiconductor industry in China [3]. In order to meet the requirements of talents in scientific and technological knowledge, innovation ability and overall quality in the new century, the teaching reform of semiconductor physics and device specialty is carried out.

Multimedia teaching means that in the process of teaching, according to the characteristics of teaching objectives and teaching objects, modern teaching media should be selected and used rationally through teaching design, and organically combined with traditional teaching means to participate in the whole process of teaching [4-5]. Acting on students with various media information, forming a reasonable teaching process structure, using multimedia computer and using pre-made multimedia teaching software to carry out the teaching process [6]. Multimedia-assisted instruction shows many advantages and characteristics in the field of teaching, such as intuition, interaction, individuality, evaluation, extension and so on. Take intuition as an example: the intervening of media greatly shortens the distance between students and textbooks. The comprehensive reform of teaching means not only provides the possibility and basis for the optimization and reorganization of teaching contents, but also guarantees the implementation of the optimized and reorganized teaching contents.

2. Significance of Semiconductor Materials and Devices Course

The development of materials plays an important role in the research and development of new technologies and technologies. Among them, the development of lighting, communication and electronics industry largely depends on the development and application of semiconductor materials. The course of Semiconductor Materials and Devices is not only conducive to students' better learning of theoretical knowledge, but also can understand the working principle of corresponding devices according to theory, and understand the use of optoelectronic devices and microelectronic devices more accurately and clearly [7-8]. Compared with optoelectronic technology, the more mature microelectronics technology has been applied to various fields. The combination of microelectronics and other disciplines has also become an important direction of development. Therefore, students trained in the direction of semiconductor materials and devices are required to meet the needs of this interdisciplinary and multidisciplinary development.

Semiconductor industry has become an important strategic industry related to national economy and national information security. Compared with Japan, the United States and other developed countries, China still has a certain gap in the field of electronic information. In the past decades, with the rapid development of semiconductor science and other related disciplines and the wide application of semiconductor devices in many fields, higher requirements have been put forward for the basic education of semiconductor materials and devices in our country in the future. Semiconductor Materials and Devices is a specialized course for undergraduates majoring in energy and electronic materials. Based on the knowledge of semiconductor physics, the basic knowledge of semiconductor physics and the working principle and performance of typical semiconductor devices are comprehensively and systematically described by combining optoelectronic devices with microelectronic devices [9]. Semiconductor Materials and Devices course involves a part of physical knowledge, which requires students to have a certain degree of physical foundation. Moreover, in the face of the complex working principle of various devices, students often feel dull and abstract in teaching. From the classroom teaching of Semiconductor Materials and Devices and the overall reflection of students, students' enthusiasm for this course is low and the classroom effect is poor. Therefore, in order to improve the quality of teaching, cultivate talents who can meet the needs of industrial development and market, and have the ability of independent innovation, the course of Semiconductor Materials and Devices is reformed.

3. The Enlightenment of Multimedia Teaching for the Reform of Teaching Means

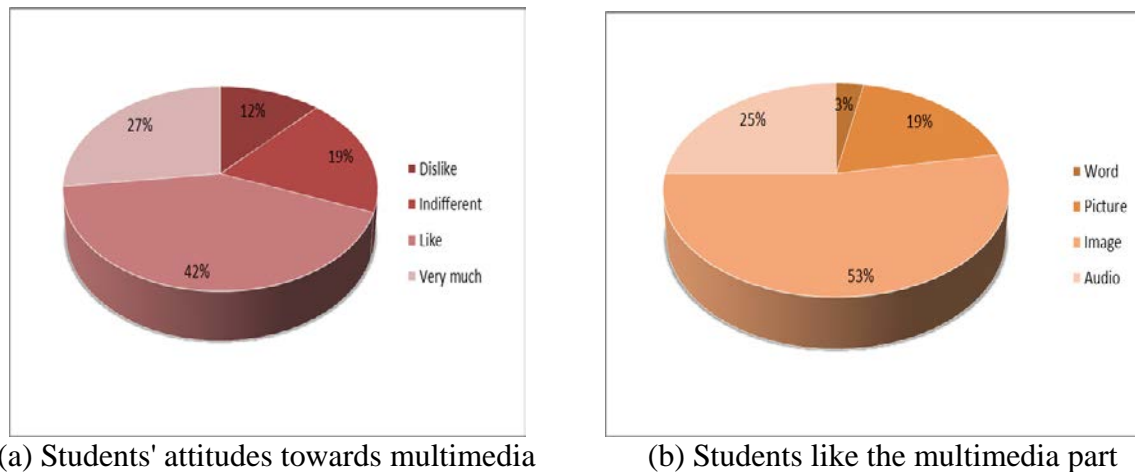
With the rapid development of computer technology, especially multimedia technology with computer as its core component, new possibilities and new directions have been brought to the reform and improvement of teaching means [10]. In recent years, various kinds of computer teaching courseware, computer-aided teaching software, computer online teaching software and remote computer teaching have flourished, showing the development direction and strong momentum of the new round of teaching means reform, as shown in Figure 1.



Figure 1 Application of multimedia technology in teaching

The application of multimedia technology also opens up a new direction for the reform of teaching methods of “Semiconductor Materials and Devices”. Multimedia teaching can vividly display the internal structure of devices and the movement of carriers, thus avoiding the phenomenon of teachers’ long Abstract narration in class and students’ little gain. Using multimedia to teach this course can intuitively transform the principle circuit, direct current path and alternating current path, draw precisely and analyze graphically, and can easily reproduce the whole analysis process many times, avoiding the difficult problems of traditional teaching methods such as on-site drawing, difficult to accurately and difficult to reproduce. Multimedia teaching can dynamically display the flow of signals in the circuit. Multimedia technology can store a large number of graphics, images and words in the computer beforehand, so using multimedia to teach in this course can greatly reduce teachers’ simple working time in the classroom. So that teachers can concentrate more energy and time on the explanation of key knowledge and important analysis methods.

It can be seen that the use of multimedia technology in teaching has incomparable advantages over traditional teaching methods in improving teaching efficiency, expanding the amount of information, integrating audio-visual, graphics, text and animation, stimulating students’ senses and reducing teachers’ labor. Especially, it solves the contradiction between teaching content and teaching hours. A survey of students' attitudes towards multimedia courseware is as shown in Figure 2.



(a) Students' attitudes towards multimedia

(b) Students like the multimedia part

Figure 2 A survey of students' attitudes towards multimedia courseware

Although multimedia technology as an advanced teaching method is widely used and even popularized in various schools, some textbooks are distributed with CD-ROMs at the same time. But if we make great efforts in the compilation of teaching software and courseware, this kind of multimedia teaching can easily evolve into just turning the original blackboard into a screen. Even though it improves the speed in listing knowledge and giving circuit, it is inferior to the blackboard in the connection of knowledge before and after, deduction and analysis, etc. If so, multimedia teaching has become a fashion. Although it improves the speed of teaching and enlarges the amount of knowledge and information, the quality of teaching is still not good. This hypothesis does not deny the direction of using multimedia to reform teaching methods, but only shows that the reform of using multimedia technology to reform teaching methods requires a lot of in-depth, meticulous and even arduous efforts. Only in this way can the contradiction between teaching capacity and teaching hours be well solved on the basis of ensuring the quality of personnel training.

4. Requirements for Making Multimedia Teaching Software

Whether it is multimedia teaching or multimedia network teaching, they are inseparable from multimedia teaching software. The development and production of multimedia teaching software should advocate the design mode of "student-centered, teacher-led", and try to use a variety of interactive means in order to make the multimedia teaching software conform to the teaching law and achieve good teaching results.

(1) The integrity and level of courseware

Courseware should include three parts: classroom teaching content, related materials and exercises. Classroom teaching content is the main part of the courseware. Relevant materials are used to enrich and supplement the difficult part in explaining the teaching content. Practice is the part to test the teaching effect. If one part of the courseware is missing, it will give people a sense of imbalance in proportion and affect the teaching effect of the whole class. At the same time, in the process of making courseware, we should also pay attention to the hierarchy of knowledge, make it clear, step by step, so that not only from the appearance of clear context, but also suitable for students of different levels.

(2) Diversity of expressive techniques

The making of courseware involves many different subjects. Because different subjects have their own characteristics, there are different ways of expression. Each subject should choose the best way to reflect teaching and learning according to its own characteristics. If we can simulate the animation of the dull function image, molecule motion, object motion law and so on, the intuitive effect will be better, and the students will be easier to understand. If we can convert a large number of realistic materials into digital signals and apply them in classroom teaching, we will surely achieve twice the result with half the effort. Some traditional teaching methods, such as charts, maps and so on, can be fully computerized into the courseware, so as not to waste some of the teaching resources in the past.

(3) Application level of software

With the continuous development of computer technology, many developers are competing to develop some multimedia applications, such as Director, Authorware and so on. A vivid teaching demonstration course needs a beautiful courseware to match it, and a courseware that can be called an artwork can make the interpretation of classroom teaching more brilliant. Therefore, to make a courseware, we need image processing tools, layout design tools, animation production tools and other application software artistic sculpture. Only in this way can the achievements meet the requirements of modern teaching and create the effect that traditional teaching methods can not achieve.

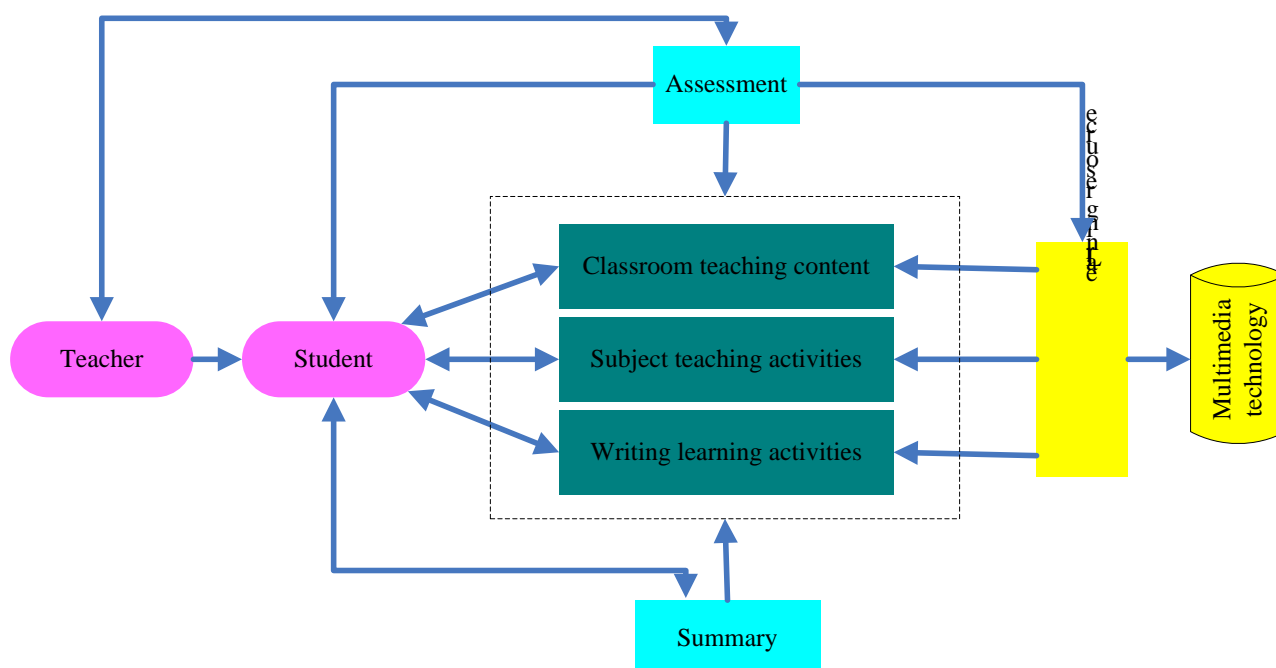


Figure 3 Interaction between courseware and teachers and students

(4) Strengthen the interaction between courseware and students

At present, the most commonly used method is to interact through practice and feedback in courseware, but it is not enough, because it does not achieve the irreplaceability of multimedia

technology and give full play to the effect of students' creativity as shown in Figure 3. In the future, our college will make further attempts in many aspects. When teaching the course of "Semiconductor Materials and Devices", we can arouse students' enthusiasm as far as possible, and let them use their spare time to make relevant courseware resources, and then explain them by students. This reflects the requirement of "advocating students' active participation, willingness to explore, diligent in doing, cultivating students' abilities of collecting and processing information, acquiring new knowledge, analyzing and solving problems, and communicating and cooperating".

With the rapid development and application of various computer related technologies, computers have become more humane and intelligent. The rapid development of multimedia technology and network technology has a far-reaching impact on educational methods. Data analysis of the impact of using multimedia courseware is shown in Figure 4. Teachers should use multimedia flexibly according to the actual situation, so that multimedia can become a powerful weapon to promote the curriculum reform of our college.

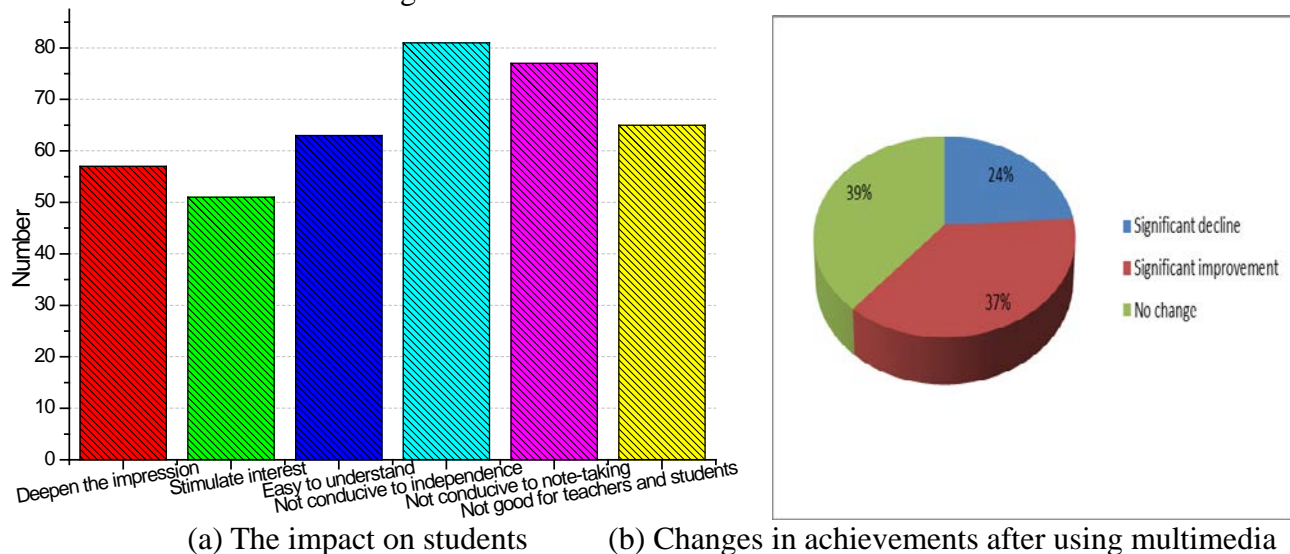


Figure 4 The impact of using multimedia courseware

5. Conclusion

Combining the teaching practice of Semiconductor Materials and Devices course and the development status of semiconductor industry, this paper carries out the reform and innovation of Semiconductor Materials and Devices combined with multimedia technology from the actual situation. It is hoped that students' interest in learning can be enhanced, the quality of classroom teaching can be improved, students' analytical ability can be improved, and comprehensive talents with self-learning ability, scientific research and practical ability can be trained to meet the needs of scientific research and social production. There are still many problems to be discussed and studied in the application of multimedia technology in the field of teaching. For example, how to grasp the degree of visual teaching and the cultivation of abstract thinking ability, how to give full play to the creativity of teachers' teaching under new teaching methods, and how to combine the unique advantages of traditional teaching methods with multimedia technology organically, all these require us to do more in-depth research and discussion.

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