Optimization and Application of Multimedia Teaching Means of Specialized Courses in Engineering

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Abstract

Multimedia teaching has been widely used in college classroom teaching and brings vigor to it. In this paper, the advantages and common problems of multimedia teaching for specialized courses in engineering are analyzed, the optimization of multimedia teaching means is discussed and suggestions about improving effect of multimedia teaching are put forward. How to minimize difficulties in both teaching and learning the course of fundamentals of control engineering is specifically studied as an example, in order to provide a new approach. The virtual simulation teaching is made possible by means of the link technique of PPT and Matlab, and hence further overcomes the limitation of PowerPoint, which could not carry out dynamic computing and plotting.

1. Introduction

Using the multimedia technology for classroom teaching has become a general trend, and college teachers are also fully aware of the advantages of using multimedia teaching. But in the past ten years, the teaching effect of many engineering courses using multimedia technology did not produce larger ascension in the teaching process. Due to some reasons, such as the low level of multimedia courseware and the lack of scientific layout of multimedia classroom teaching, there were some common problems affecting the teaching effect. To solve the traditional teaching difficult problems should be the premise of multimedia teaching. It should be in accordance with the teaching features of the subject and the teaching principle, should take the students' cognitive law as the essence. Also, it should take developing the students' ability and improving the teaching effect as the goal. So, according to teaching features of the course, how to scheme the content of the multimedia courseware and expression way reasonably, how to use multimedia courseware in teaching process, bring multimedia teaching advantage into play, ensure the
effectiveness of the multimedia teaching, are the problems that every teacher should think. This paper analyzed the advantage of engineering courses using the multimedia teaching, the common problems in 10 years of multimedia teaching process, and put forward several suggestions of optimizing multimedia teaching means. How to minimize difficulties in both teaching and learning the course of fundamentals of control engineering is specifically studied as an example. The virtual simulation teaching method using PPT and Matlab link technique is introduced, which could realize dynamic computing and drawing.

2. Advantages of engineering courses using multimedia teaching

A. Introduce the most advanced information of the subject; reflect features of specialized courses

Compared with the teaching of specialized course and basic course, the first has epochal character, applicability, innovation, and involves knowledge broad which is inconstant, updated quickly and with other characteristics. It is integrated with times closely, reflects the development and trend of science and technology, economy and society. The knowledge and theory of specialized course is leading and innovative. But the materials teacher used or referred usually lag behind. Teachers in the lecture with multimedia courseware, can not only show the focus of teaching material contents, but also keep the latest professional knowledge into teaching, then transfer to students, so as to keep up with the pace of the development of times, really reflect the characteristics of specialized courses. As the most convenient carrier, the multimedia teaching brings new results of achievement, makes the students' knowledge structure undergone a fundamental change.

B. Increase the amount of information; improve teaching efficiency

The multimedia teaching by its unique audio, video, animation, and other functions makes the teaching content intuitive and visual thus in the effective time provides abundant information resources for students. Specialized course contents are often various and complicated. The number of the class arranged is usually in contradiction with the actual demand, while the multimedia teaching means could save the time teacher used in drawing and writing on the blackboard. It is good to solve the contradiction, and improves the classroom teaching efficiency. At the same time, the multimedia system with hypertext characteristic can also realize the most effective organization and management for teaching content, and make the classroom teaching more compact and abundant.

C. Enrich the power of expression; stimulate students to study

Specialized courses generally have certain difficulty, breadth and depth, make quite a number of students' learning up more difficult. The multimedia teaching emphasizes on the use of modern teaching technology, makes the expression of charts, data, voice, animation and so on which are difficult to be expressed in traditional teaching means shown visually, vividly and intuitively. It makes the theory teaching, case studies, workshops and situational teaching combined, creates lively teaching atmosphere, and stimulates students' interest in study. It also makes students to accept knowledge faster and better, reaches the acme of perfection of the teaching effect.

D. Facilitate links of knowledge and the supplement or deletion of some content

In the teaching of specialized courses, the difficulty of the content constantly increases with the deepening of teaching process. Because each section of the content is related, if students can master what
they learn in time, they will be relaxed freely in learning. Multimedia courseware page layout can be free to combination, jump and link. This just makes old and new knowledge to be mastered more simply and conveniently. Through the links which connect related knowledge, teachers can be flexible in every interface switch and save time. In addition, teaching content needs to be changed in time with professional knowledge updating. The multimedia teaching according to the change of the content can be readily expanded and refinement, avoiding the teacher repeated labor for writing lesson plans.

3. Common problems of multimedia teaching of specialized courses

A. Low quality of multimedia courseware

In the current college multimedia teaching, teachers generally present using the slide show form. The courseware quality is worrying. Some courseware is too simple; its content is mostly copied from the book and some teachers even take the courseware as electronic notes. Many teachers in the classroom just read courseware. The teaching method returns to the traditional model—"read textbooks". Instead, some teachers unilaterally emphasize on the courseware format, layout and skills, don't pay attention to the scheme of teaching content and the students' needs to audio-visual senses. There are some unnecessary content of audio, images, video, etc in courseware. This kind of practice that emphasizes on the form of expression and ignores the content will mislead students to pay much attention on the external form of the multimedia courseware, and ignore the teaching content, can not reach the teaching goal.

B. Lack of communication between teachers and students, due to too much information in courseware and high speed in teaching

Multimedia teaching can save writing and drawing time on the blackboard, increase knowledge amount. But some teachers fail to effectively use the time saved on students' thinking or extended range of knowledge. Their teaching content is too fast and much. This makes the minds of students couldn't keep up with teacher's explanation, violates the cognitive laws, and affects the students' perception, memory and understanding of the learning content.

C. Ignore the key points and difficult items for teaching

Multimedia courseware for teaching content should be the most briefly tips and summaries. At the same time, teachers should strive to use multimedia rich expressional means to explain teaching emphasis and difficulties deeply in the teaching process, so that students could remember profoundly. However many specialized teaching courseware like bills, don't have change in width and depth. Some teachers feel that every piece of material in collecting forward knowledge has characteristic. The result leads that the content of supplement becomes the key points and it dilutes the emphasis and difficulty of the teaching content.

4 Several suggestions of improving multimedia teaching

A. Elaborate multimedia teaching: improve the layout of the courseware

The scheme of multimedia courseware should follow the principle of serving for teaching goal. Multimedia courseware of engineering courses should comply with specialized courses teaching rule. According to the character and content of the course, the courseware should be reasonably combined with
various forms of expression, in the right time with proper media forms. Teachers must understand the
dialectical relationship between form and content. We should be according to the content to choose the
most suitable media types when making courseware. And it should express content in the most easily
acceptable way. Don't only pursue the appearance of courseware, ignore the real thematic understanding;
or courseware making unilaterally pursues appearance, pays much attention to visual image and screen
rendering; additional and irrelevant information is too much. This cannot play the role of attracting
students' attention, but easily spread it, causing learning fatigue, decreasing learning effect and producing
adverse effect for teaching, consequently losing the value of multimedia technology. Therefore,
multimedia courseware must put teaching content as center; the performance forms of video, images and
scenes should be mainly used for teaching key points, doubtful points and difficult problems.

B. Strengthen interaction between teachers and students, with the former as a leading part and the latter
the main part

The use of multimedia should follow and insist on the principle of auxiliary, and highlight student's
main part status and role. Teachers should hold the leading position and role in teaching. While making
and using the courseware, teachers should pay attention to student's actual situation, avoid using the
courseware play instead of teacher's inspirational explanation, not use "human-computer interaction"
instead of "interpersonal dialogue". The teaching courseware should be developed for the purpose of
imparting knowledge and constructed multimedia teaching form for learning as center. Through teaching
process plan and flexible operation, multimedia can be used best. At the same time, teachers should
discuss the basic laws of multimedia teaching from the relationship of teaching contents and multimedia
technology application.

Teaching should be the interaction of teachers and students, in the traditional classroom teaching, the
teacher can communicate with students through language, expression and action. Students are
unconsciously influenced by teacher's every movement, and teachers can also accept and analysis
information transferred from students constantly to make corresponding adjustment through observation.
In multimedia teaching, teaching process controlled by courseware is too tight and compact, often limits
teacher's temporary play and communication between teachers and students. Teaching ideas will be
limited by courseware. This makes teaching process of specialized course lost teacher's vivid logical
deduction. Sometimes teachers may directly give conclusion, and then the teaching process becomes
difficult and boring. So we should pay attention to deal with the relationship between content of the
courseware and students' individuality thinking. The principle should be adhered to taking students as the
main part, teacher as the leading, the combination of teaching method and form, and use them freely.

C. Blackboard and multimedia complementary to each other

Derivation of equation and problem solving of specialized courses should be presented on the
blackboard. The teacher can reproduce the detailed content on the blackboard with students' thinking
synchronization. Students need time to understand knowledge, master the methods and skills. The
teaching process is the students' cognitive process, students need to think, ratiocinate and imagine
independently. Their logical thinking ability is gradually formed by teacher's slowly deducing and
computing, not through quick multimedia presentation, speeding up teaching process, and ignoring
students accept ability. In addition, many teachers in multimedia teaching will appear inspiration, which is
often the excitement of teaching art, and it can be presented through writing on the blackboard to make up
the missing content of the courseware. Sometimes, teacher can also write the key words of important
content on the blackboard to deepen students' impression.
5 The realization of simulation teaching of fundamentals of control engineering

A. Teaching characteristics of fundamentals of control engineering

This paper takes the course of fundamentals of control engineering as an example to illustrate the application of multimedia teaching. It is a basic and required course of mechanical engineering. It discusses the extract and abstract problems from the basis of engineering practice, and then analyzes and designs the common problems of control system. It has much theoretical content, abstract concepts and involves a wide range of knowledge. Students need different mathematical knowledge. It is not like some specialized courses can let the student learn practical skill instantly. Therefore, students feel that the content is too abstract, learning objective is not clear. And because their mathematical knowledge is relatively weak, learning is more difficult, the initiative is poor. They generally feel learning boring and difficult.

According to the characteristics of curriculum, we should select multimedia material rationally, take appropriate teaching modes and methods, reasonably use various teaching means complemented each other to bring their own advantages into play in order to make teaching contents lively, save classroom teaching time, enrich teaching content, increase the amount of information, and reduce learning difficulty.

For example: when teaching the concept of closed-loop control system, the teacher can through the animated simulation to show how changes in the output feedback to the input end, then the system how to reduce difference to make the output automatically follow the input of the changes. But the formula analysis and derivation is difficult to understand. So, for formula derivation, theorem proof and problem calculation process, slide show is not as good as demonstration on the blackboard. The content on the blackboard can be preserved, facilitates students to think and understand. While the concept and principle, which is needed to be understood by complex calculation and drawing, can be simulated by dynamic calculation and plotting through link technique of PPT and Matlab. The complex mathematical operations can be processed by the computer to make full use of Matlab strong analysis, calculation, drawing and simulation functions. The dynamic simulation teaching is intuitive and vivid. It is helpful for students to understand abstract concepts and theories, reduce teaching and learning difficulty. Students don't have to carry out complex mathematical operations and drawings; can put the main focus on understanding basic theories, principle and the characteristics analysis, comprehensive design of control system. This way can reach the purpose of improving teaching quality and training students' comprehensive ability.

B. Virtual simulation teaching method

At present CAI courseware is usually made by PPT. The virtual simulation teaching is made possible by means of the link of PPT and Matlab using ActiveX technique, and hence further overcomes the limitation of PowerPoint, which could not carry out dynamic computing and plotting.

ActiveX is a technique can use and integrate component, it includes automation server and controller. Automation server is a kind of components driven by other application programs. Automation controller is an application program controlling automation server. Matlab and PowerPoint is automation server and automation controller respectively, both are integrated by VBA. VBA is the second development language derived from VB in Office software, and it has powerful functions. The statement in VBA to create Matlab object is:

```vba
Dim matlab As Object
Set matlab = CreateObject("Matlab.Application")
```

The statement of executing orders for Matlab is:
result = matlab.Execute(h)

1) Dynamic simulation plotting

Create a slide, as shown in fig.1, use "control toolbox" to create a "graphic display box" for show the simulation diagram, a "text box" for enter the program, a "button" for simulation. The corresponding property of the controls is set up.

The VBA code for simulation button is:

Private Sub CommandButton1_Click()
    Rem
    Dim h As String
    Dim result As String
    Rem
    Dim matlab As Object
    Set matlab = CreateObject("Matlab.Application")
    Rem
    result = matlab.Execute("set(gcf,'visible','off');")
    h = TextBox1.Value
    result = matlab.Execute(h)
    result = matlab.Execute("print(gcf,'-dtiff','c:\a.tif');")
    result = matlab.Execute("x=imread('c:\a.tif');")
    result = matlab.Execute("imwrite(x,'c:\a.bmp');")
    Rem
    Image1.Picture = LoadPicture("c:\a.bmp")
    SlideShowWindows(1).View.GotoSlide 1
    Rem
    result = matlab.Execute("c:\a.tif")
    result = matlab.Execute("c:\a.bmp")
End Sub

Output picture box in Fig.1 shows the response curves when damping ratio is different.

2) Dynamic simulation computing

Create a slide, as shown in fig 2, use "control toolbox" to create two "text boxes" for input program and output result, a "button" for calculation. The corresponding property of the controls is set up.

The VBA code for compute button is:

Private Sub CommandButton1_Click()
    Dim h As String
    Dim result As String
    Rem
    Dim matlab As Object
    Set matlab = CreateObject("Matlab.Application")
    Rem
    h = TextBox1.Value
    Rem
result = matlab.Execute(h)
Rem
TextBox2.Value = result
End Sub

Output box in fig.2 shows the calculation results of second-order system performance index.

\[ G(s) = \frac{1000}{s^2 + 20(s + 50)s + 1000} \]

In the projected state of PPT, enter Matlab program in the input text box, and then click "simulation" or "calculation" button, it can get the corresponding results in "graphic display" or "output result" box, to implement online simulation. In classroom teaching, the course content often involves complex mathematical calculation and multifarious engineering drawing, and the program is relatively complex, so teachers can copy program compiled in advance directly or make simple modifications on the basis of original program.

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References


