

Research on Innovation of Course Teaching *Utilizing Technology of Construction Machinery*

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Abstract

The effectiveness of teaching course, *Utilizing Technology of Construction Machinery*, is less-than-ideal when the teaching activities take place in a closed classroom. Then some measures for teaching innovation were presented and practice in the course teaching. And the measures include reformation of course content, changing teaching method, and innovation of teaching techniques. Finally, students acquired the technical abilities on construction machinery and the satisfying effect of cultivating compound talents were achieved after the course contents have been innovated and the teaching methods have been improved.

Keywords

Construction Machinery, Utilizing Technology, Innovation, Teaching Method, Teaching Technique

1. Introduction

The course, using technology of construction machinery, is an important professional course for the students who major in machine design and transportation construction equipment. The teaching objective of the course for students are that fully mastering the using skills of road construction machine, grasping the method of prepare road construction machine using rules and knowing new techniques and developing trends of road construction machines [1]. The course tends toward the practices and intellectual, always updates speedy annually. So it is considerable difficult for teacher's teaching and student's studying. And the classical teaching emphasis on transfusing knowledge to students and studying theory words. To do this could not satisfy the learning demands of students majoring in construction machinery and other allied professions in university.

Then reformation and innovation should be carried on in the field of teaching and studying the course.

2. Reformation of Course Content

Content and structure of the course is a Key to achieve the teaching goal [2]. The reformation of course structure demonstrated that the course content was divided into two parts, regular maintaining and work operating, according to actual using situation. One part of the content includes: regular maintaining, oil usage and fault diagnosis. Other part of the content includes: using technology of engine and drive system, the using skill of earth-rock machinery and pavement construction machinery. So something new, such as teaching object, course features and learning methods, has been added in the first chapter, Introduction, for students' studying systematically. Some new knowledge and skills, such as modern measuring and control techniques, how to operate construction machine accurately, have been embodied in the chapter, pavement construction machinery, in order that students could manage advanced machinery to carry on mechanization and informationalized construction for highroads.

The dominating rope, ordinary-work time, connects all chapters formatively together. Except choosing new textbook, the latest relative scientific payoffs and development tendency were added into course content to ensure that students master new technique and new equipment in time. In view of students' studying difficulty of the content in some chapter, some typical comprehensive exercises were placed after every chapters in order to invigorate teaching effects.

3. Reformation of Teaching Method

3.1. Discovering Emphasis and Cultivating Students' Self-Study Abilities

There are three important factors in the course. First one is course emphasis, such as mechanical structure, working principle and method of application. Second one is the difficulty, something could not be understood easily by students in the course. And last one is the key point, which is a logical relation among three factors in the course. The relationship of three factors should be managed well in the course of teaching. Based on knowing essential structure of road engineering machinery and mastering their basically working principle. The teaching aims at students' understanding fundamental utilizing techniques. The utilizing techniques were extracted from actual work and summarized to some statement as lines of articles for presenting to students. But most students dislike listening or reading these articles. Teaching the relationship of three important factors, structure-principle-utilize, and explaining these articles means necessary and popular for students. Meanwhile, aimed at students with strong comprehensive ability and correlative basic knowledge, the attentions have been paid to cultivating students' ability to study independently. And students have

been prompted to expand their horizon, enhance their understanding the course content through many ways during their learning. Some controversial problems and uncertain anything in textbook were selected and laid as students' homework for improving their ability to think and study independently.

3.2. Heuristic Teaching Based on Multimedia

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The so-called multimedia teaching is a showing method, it is taken full advantage of multimedia technology, which is based on imaginal thinking, logical thinking. It can intuitively present nonobjective words used to describe utilizing technology of construction machinery in some images, animation or video. In class teachers could tell and demonstrate all utilizing technology by this new multimedia courseware. The heuristic teaching is be abided by common rules of cognitive activity for human. And teachers could like to play a dominant role of better. Students' learning enthusiasm would be stimulated through this interesting teaching method. Also their imagination and discernment were enhanced. Students could master construction machinery operation and its maintenance techniques with the help of multimedia based heuristic teaching before entering the workplace. Then combined with practical operation, it could ensure integration of theory teaching and practical application.

3.3. Interactive Teaching Method

Teacher would like to transform key something, which would be discussed in class, into one or several questions for students before starting lecture. Questions would make students interested in next lecture. Teacher would like to introduce students seek how to analyze and solve questions. Students would like to build relationship between what is know and what is unknown with the help of teachers. Due to teacher's correct introduction and students' active participation, an interactive teaching has been implemented during the figuring out problems. Then teaching content and solving problems have been linked with each other because teachers have lead students discover problems and find methods to solve problems in the course of teaching, the ability of creative thinking has been cultivated sequentially.

3.4. Novelty Multimedia Courseware

The course, using technology of construction machinery, focus on training the skill of actual construction field for students. But students do not always go to construction sites to meet various construction machinery due to limitation of

teaching condition. Multimedia courseware is a new aided teaching way with bright image, vivid picture, versatile music and video through computer technique to optimize teaching. Excellent multimedia courseware can vividly show some scenes which hardly be expressed to students, such as technical links, something difficultly observed in reality. The learning method, comparing knowledge expressed by words with by multimedia, could help students intuitively see technical details to generate sensory awareness rapidly and fully. So we have gone to some construction sites for collecting much images, pictures, videos and then selected, edited and modified the quondam courseware which was mainly represented by words.

4. Innovation of Teaching Techniques

4.1. Choosing Computer Demonstration Method

Some seemly demo techniques should been to found for making more helpful courseware because there are much operation process of machinery working and maintaining, much actual construction scene to show for students who are lack of work experiences. Nowadays several computer image techniques could be used to show construction sites, such as stereopsis, flat image, and animated demo.

Stereopsis is the best effect of showing 3-D images with abundant colors and watching convenience. While commercial 3-D equipments are costly, huge and their film source are complicated to fabricate. The whole stereopsis showing system is difficult to implement due to 3-D playing software have some functional defects. Lots of funds, techniques and workers settle for the needs of setting up teaching stereopsis system.

The flat image technique also can vividly show some scenes which hardly be expressed to students, such as technical links, difficultly observed micro phenomenon in reality. But the images and video conforming to teaching content is not easy to shoot. Images and videos always have to been selected, edited one by one then the proper courseware meeting teaching demands would come into being based on abundant information on actual construction sites. Even some images and videos could not be found through shooting in construction sites. So the relative animation have been created by computer software to show the detail of actual machinery working process as necessary parts of the courseware.

4.2. Creating Teaching Animation by Flash CS6

Courseware animation is often divided into two types, one is 2-D, and the other is 3-D.

3-D animation could factually show the mutual position and movement of items in simulation space. 3D MAX is most popular software to utilize making 3-D animation of courseware. But 3D MAX is a specific software and difficult to learn so well for common teachers. The object modeling, assigning material, setting light, special effects and moving parameters and eventual rendering, every

steps and every operations, are all very complicated. Fabricating a perfect 3-D animation would spend much time and attention for makers. It is very unsuitable for teachers who always are busy in task-based teaching. So 3-D animation with high complexity or effect is not a preferred scheme for making courseware.

2-D animation is an abstract of moving process, it does well in showing every kind of object's motion in a flat. Now the software, Flash, is a preferred Software to make 2-D animation during fabricating courseware. It has versatile functions for fabricating 2-D animation as its using and operation are rather handy. Many animation effects such as moving, rotating, transforming, could easily implement by Flash. Among most fabricating animation software, learning Flash CS6 is more undemanding. Teachers could fabricate animation they needed after elementarily learning.

According to the item which is shown by the animation in the courseware, the animation fabricated by us could divided two kinds, the one is working process animation of earthmoving machine, and the other is compact machinery. The following two examples would explain how animations show the machines' working processes in the courseware.

1) Excavator's working process. Excavator's operation specification appoints that correct working face should be careful to select and establish, strictly prohibit that the excavator hollow out earth, some protective measures should be taken when an excavator works at cliff sides, big loose or protruding stones should not reveal at working face, and if dangers, as collapses have be detected, some measures should be taken or excavators should be withdrawn to safe areas at once [3]. So relative animation was fabricated to show these excavating processes. A picture was chosen from animation as **Figure 1** shown.

Excavator's operation specification also appoints that an excavator is strictly prohibited to strike hard objects with its bucket, doing so will result in bucket teeth or plugs' fracture and big arm's inflecting. Then relative animation was be fabricated to show these excavating processes. A picture was chosen from animation as **Figure 2** shown.

2) Vibration compacting process. Compaction of vibratory roller is generated from the relative motion between the eccentric block in vibration generator and steel wheel [4]. It is very necessary that showing compaction process for students is helpful to understand the working principle of vibratory roller. Working situation in vibration generator could not be observed and shoot from vibratory roller's outside due to it is blocked by other parts. So relative animation was be fabricated by Flash CS6 to show inner working processes. A picture was chosen from animation as **Figure 3** shown.

In the course of compacting, more slowly velocity, lower efficiency. The flatness of compaction surface would be affected badly by over-rapid velocity. Likewise, the relative animation was be fabricated by Flash CS6 to show the compacting processes. A picture was chosen from animation demonstrating fluctuation of compaction surface caused by over-rapid velocity as **Figure 4** shown.

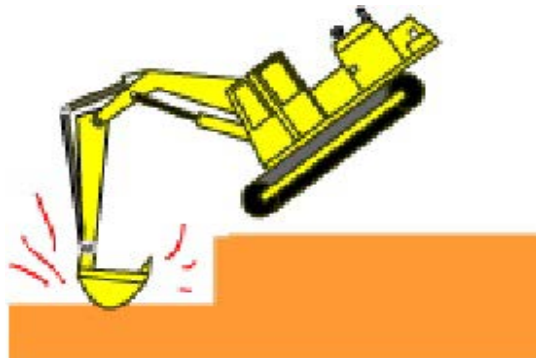


Figure 1. Excavator's dangerous working at cliffside.

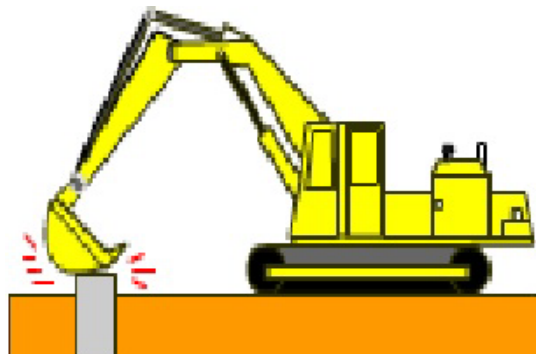


Figure 2. Excavator's digging a hard object.

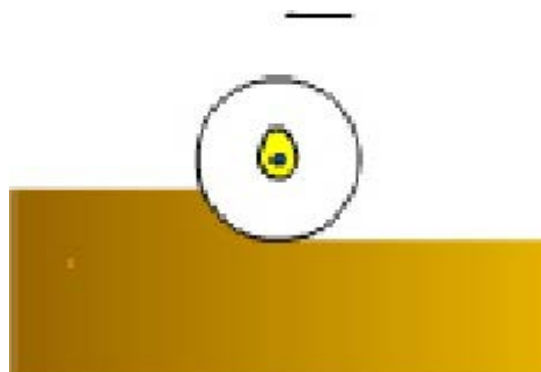


Figure 3. Vibrating drum's compacting process.

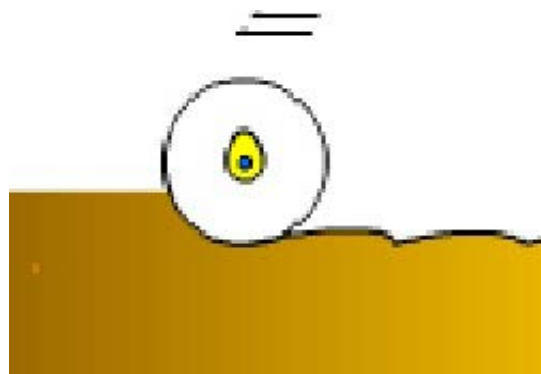


Figure 4. Effect of over-rapid compacting velocity.

4.3. Embodying Flash into PowerPoint

Animation files fabricated by Flash software often are smaller with clear beautiful picture, better interconvertibility. Invoking Flash movie files in PowerPoint is commonly adopted by most teachers [5]. The method is that action button is added in PowerPoint slide firstly, then setting motion window is opened, Flash animation files is played by running program option. Utilizing the above method, PowerPoint would not like to smoothly play in the actual teaching course, even sometimes the playing disconnected from the course. As our having studied, The Flash movie could be embodied into PowerPoint, directly play like a common video file. The brief steps in PowerPoint 2007 are shown as following steps.

- 1) Find shockwave flash object controls in the controls box.
- 2) Add VBA-project and set the Flash property.
- 3) Input the Flash file a new name with a new extension in URL (M) dialog box, return PowerPoint and play movie after determining.

Then the pictures of Flash movie would be watched immediately.

4.4. Innovation of Examination Mode

Multi-fashions examination mode including random questions, simulating questions, thinking questions and course test, has been established for the goal and mode of the professional cultivating. Firstly, the goal of the exams has converted from memory ability testing to comprehensive testing and more suggestive questions has appeared in exams in order that students would like to deal with professional problems by new knowledge, not their memories. Secondly, test mode has been changed from single written examination to versatile examination. Sequentially, students would be focus on understanding and applying knowledge having been learned in the course.

5. Conclusion

After innovation of the course, utilizing technology of construction machinery, the teaching innovating has been carried out in the aspects of course structure, course content and teaching method. Sequentially, the new direction of development suited for construction machinery and other allied professions in university has been reviewed and summarized. That is, the course teaching should concentrate on tightly coupling theory knowledge with practical skills, for training a batch of compound talents who could really deal with something in actualy construction fields.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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