



# Application of Multimedia Technology in the Training Course “Thermal Theory and Application” for Enterprise Employees

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**Abstract.** With the rapid development of electric power enterprises, electric power enterprises should be upgraded to a new type of organization that constantly learns, creates and uses new knowledge and technology to meet the needs of modern power production and operation. This requires strengthening the training of enterprise staff. Vocational colleges shall carry out social vocational training and participate in the training of business skills of enterprise employees. This is not only in line with the purpose of higher vocational education, but also can realize the important function of higher vocational colleges to serve enterprises. Combined with the course of thermal theory and application, some ideas are put forward from the principles, contents and teaching methods of course construction, hoping to build it into a training course which can meet the needs of enterprise training and satisfy the enterprise.

**Keywords:** Multimedia · Training

## 1 Introduction

In addition to helping higher education, higher vocational colleges are also faced with the arduous task of vocational training and serving the society. Therefore, the problems faced by power enterprise trainers are as follows: How can we not only make the training class relaxed and happy, but also make the training effective and practical. This determines that the trainer’s function also has certain particularity, he should have his own unique training skills, reflecting his own teaching characteristics. If you want to have a good training course, you should understand the learning needs of the trainees and pay attention to the training process, which can not only make the training course easy and interesting, but also help the employees.

## 2 Principles of Curriculum Construction

### 2.1 Correct Positioning to Meet the Needs of Enterprise Development

With the development of economy and the progress of science and technology, more and more high-quality and high-tech talents are needed for power enterprises. This makes the

training of power enterprises more and more close to the actual needs of the profession. Trainers should combine the technical development and employment requirements of power system, research and develop the training for each post of power system. It is particularly important to pay attention to the practical knowledge and skill training of each post. Modern training is to make trainees acquire knowledge and skills related to work requirements through training, practice and guidance.

“Thermal theory and application” is a basic course of thermal power engineering. It is an indispensable cornerstone for employees of power enterprises to master professional courses.

## **2.2 Grasp the Content and Embody New Knowledge and Skills**

The most important feature of enterprise training is that it has post pertinence. The quality of a training course construction first depends on whether it fits the job needs. Therefore, the construction of a course must have a clear goal, combined with the actual situation, understand the enterprise situation, understand the job, in order to determine the training content. Therefore, in the process of curriculum construction, we should have a clear goal, combined with the actual situation, understand the enterprise situation, understand the job. Due to the more emphasis on skills training in enterprise training, enterprise trainers need to go deep into the actual work, master the specific job content, in order to determine the actual training content. Thermal power engineering major mainly involves the operation, maintenance and repair of boilers, steam turbines and their auxiliary equipment. The working medium is water vapor, and the steam power cycle is used to realize energy conversion. According to different jobs, the contents of “thermal theory and application” can be divided into several modules. Then the modular training content is determined.

## **3 Content of Curriculum Construction**

### **3.1 Course Objectives**

Curriculum objectives provide the direction of learning and the standards to be achieved in each stage of the learning process. Through the training of thermal theory and application, the trainees mainly master the basic concepts and laws of thermal engineering, learn to apply the laws to the actual steam power cycle, master the concepts and laws of heat transfer, and be familiar with the relevant contents of heat exchanger.

### **3.2 Trainees**

Front line technical workers engaged in Thermal Power Engineering.

### **3.3 Course Content**

The course content is selected and combined to achieve the course objectives, especially the scope and sequence. Based on the principle of necessity and sufficiency, we modularize the whole content of “thermal theory and application”. As shown in Table 1.

**Table 1.** Course content table of “thermal theory and Application”

Serial number	Content module	Main contents
Module 1	Basic knowledge of thermodynamics	Basic concepts of thermodynamics
		Thermodynamic state and basic state parameters
		Thermodynamic process and parameter coordinate diagram
		Calculation of heat
Module 2	Basic laws of thermodynamics	Concepts of work and heat
		The first law of thermodynamics
		Second law of thermodynamics
		Thermodynamics process of ideal gas
Module 3	Water vapor and wet air	Generation of water vapor and its parameter coordinate diagram
		Mixed gas
		Wet air
Module 4	The flow of gas and steam	Basic process of steady flow
		Flow of gas and steam in nozzle
		Adiabatic throttling
Module 5	Steam cycle	Steam power cycle
		Compressed steam refrigeration cycle
Module 6	Heat transfer and heat exchanger	Heat conduction
		Thermal convection and convective heat transfer
		Thermal radiation and radiation heat transfer
		Heat transfer process
		heat exchanger

### 3.4 Teaching Material

Any training is inseparable from the training materials. Training materials cannot be equated with textbooks. It should be a “condensed book” that integrates theoretical knowledge and skill requirements. It should be closely related to the training content, and closely combined with the actual situation and post work. According to the learning objectives and students’ characteristics, we can choose suitable new teaching materials or compile new teaching materials. Teaching materials should be guided by the development needs of new technologies and new skills of enterprises, and focus on the cultivation

of professional ability. The selection of teaching materials should be individualized and flexible. In the process of compiling the textbook of thermal theory and application, we paid full attention to these, compiled textbook suitable for training of electric power enterprises, and also selected the relevant textbook as reference textbook for the training.

### 3.5 Curriculum Model

One of the differences between enterprise training and academic education is that the trainees they face are uneven. We should understand their age, education background, qualifications, experience, acceptance ability and so on, and adopt appropriate training methods. Case analysis, discussion, communication, simulation training and games are often used in teaching. We can also take appropriate imitation practice, demonstration practice and other ways according to the relevant teaching content. Enterprise trainers have two roles: one is a teacher, the other is a mentor. As a “teacher”, it is necessary to impart the basic theory and professional knowledge that the employees need to master to the training objects, that is “imparting”. As a “mentor”, we should be able to guide and inspire employees to develop ideas and actively seek, so as to master skills, increase level, improve ability and solve problems.

Teaching method is the key and breakthrough point of teaching reform. The idea of task driven teaching mode is to divide teaching into practice teaching and theory teaching. In this stage of practical teaching, the task driven approach is used to achieve teaching, and then it naturally transits to the theoretical teaching stage. That is, first of all, put the knowledge and skills to be learned in the task, and take the task as the guide to improve the students’ interest; Secondly, some necessary knowledge and skills should be applied to solve the task, and students should use these skills to complete the task; Finally, in the face of a satisfactory task result, naturally we have to think about why, understand why, and the theoretical teaching is basically completed. This is a process of inquiry learning in which we first define the knowledge and skills to learn, and then master the required theory. It is a fascinating process. In this process, trainees are the main body, trainers are the leading role, trainers play the role of organizers, guides, helpers and promoters. Make full use of the learning environment elements such as situation, cooperation and conversation to give full play to the students’ initiative, enthusiasm and creativity. Finally, it can make the students realize the meaning construction of the current knowledge effectively. Students’ continuous sense of achievement can stimulate their desire for knowledge and gradually form a virtuous circle of perceptual mental activities, so as to cultivate their self-learning ability of independent exploration.

### 3.6 Teaching Method

The development of information technology makes great changes in teaching methods. Many things that are boring and difficult to understand in traditional teaching methods can be shown intuitively and easily through multimedia technology. The use of network and multimedia technology can not only improve the scientific and interesting teaching content, but also strengthen the real-time communication between trainees and trainers. Take a simple example: For the process of water vapor generation, it is difficult to understand and imagine the concept of “superheated steam” simply by relying on

the experience of “boiling water” in daily life and a few pictures in textbooks. If this process is visually displayed in the form of animation, students can clearly distinguish the similarities and differences between the production process of industrial water vapor and the production process of water vapor at home.

We can combine the different characteristics of each module to make the courseware of this part, and then integrate it into the multimedia courseware of the whole course. In the process of teaching and training, we can choose according to the specific teaching content. It supports both online teaching and offline self-study. It supports all devices of computer, wechat and mobile app, and has all functions of live teaching, on-demand recording, educational administration management, online examination database, etc. It has the characteristics of fast building, supporting customization and simple operation. Each module can include teaching system, self-study system, evaluation system and management system. It can feed back the situation of teaching and learning in real time, so as to make adjustments in time.

Steam power cycle and compressed steam refrigeration cycle are the most abstract and difficult parts of this course. If we can use animation to show the complex process clearly to the students, and use the advantages of multimedia teaching, we will achieve very good teaching effect. We take steam power cycle as an example.

### **1) Firstly, give T-s diagram of each cycle and analyze composition processes of each cycle.**

Firstly, T-S diagrams of Carnot cycle, Rankine cycle, reheat cycle and regenerative cycle are given at the same time. And the first question is put forward to students, that is to analyze the composition process of each cycle with the knowledge learned by combining T-S diagram. Here, we need to emphasize one point: The T-S diagram of four cycles must be given on the same page. It can be played on the large screen with multimedia at the same time, which can save time. It can also be drawn on the blackboard in sequence. The process of drawing actually plays a role of prompting for the students. So each has its own advantages. When four different but similar T-S diagrams appear on the same page, corresponding to four different circulation names, the concept of “contrast” will first be established in the mind of the students, and it will prompt them to quickly analyze the composition process and find out their differences. On this basis, the symbols of each equipment are given, and students can easily draw the device system diagram corresponding to T-s. It also strengthens the “contrast” and deepens the memory.

### **2) Explain that Carnot cycle is not used in actual production, find out the reason.**

It should be affirmed to the trainees that Carnot cycle is not used in actual production. At the same time, the second problem is to find out the reason why Carnot cycle is not used. It is suggested that the limitation of Carnot cycle can be found by finding out the commonness of the last three cycles combined with T-S diagram. Combined with four T-S diagrams, it is easy to find that the position of each process line in the diagram is different. So we can guide the students to sum up these intuitive phenomena with the course description. Simple with a little difficulty, so as to guide the students not to despise the idea because of the simple problem, and suggest that we should not only be satisfied with the intuitive phenomenon when analyzing the problem, but also be able to make in-depth analysis from the outside to the inside.

### 3) Calculation of cycle thermal efficiency.

In order to analyze the thermal efficiency expression of each cycle, it is necessary to have a clear account of the heat or work of each component process. The task of this link is heavy. In order to avoid losing enthusiasm due to the difficulty of the problem, we can assign tasks in groups. Students can be divided into three groups according to different cycles, or they can be divided into four groups according to the four types of processes that make up the cycle. Group competition not only enlivens the atmosphere, but also enhances the sense of participation. We should remind the students that the same initial parameters and the same final parameters, different cycles, get different calculation results, “compare”, and think about “why”. Lay the foundation for the next step of analysis.

### 4) Analyze the influencing factors of cycle thermal efficiency and find out the way to improve cycle thermal efficiency.

Through the calculation in the previous section, it is found that the Rankine cycle has the lowest thermal efficiency among the cycles with the same parameters. The third problem is put forward to students: combined with the calculation formula of thermal efficiency and T-S diagram, analyze the factors affecting the thermal efficiency, and find out the ways and methods to improve the thermal efficiency.

Students look for many differences in the comparison. In fact, they can also find commonalities in the comparison: no matter how the cycle is improved, their thermal efficiency is generally low. So there is the next link how to improve energy utilization.

### 5) Analysis of two ways of Cogeneration Cycle.

Combined with the previous “comparison”, we can summarize various measures to improve the cycle thermal efficiency. However, the thermal efficiency of modern steam power cycle is only about 50% in spite of various methods and measures to improve the thermal efficiency. In other words, quite a lot of heat released by fuel combustion is used to do work, which means half of the heat is wasted. The fourth problem is how to improve the utilization of energy. So it leads to the cycle mode of cogeneration. Based on the system diagram of Rankine cycle and regenerative cycle, we can get two ways of cogeneration cycle: the ideal cogeneration cycle and cogeneration cycle with adjustable loads.

### 6) Summary.

In the teaching process, it is also very important to summarize each part of the teaching content in time. This will not only help students grasp the whole knowledge, but also help them grasp the key points. The form of summary can be diverse, such as: comparison method, table method.

Using the above method to teach this part of the content has received very good results.

## 4 Problems Needing Attention

In the course of thermal engineering theory and application, trainers should pay attention to several problems: Trainers must consciously improve their own scientific and cultural literacy; A qualified trainer should love the training career and have a strong sense of

career and responsibility; The trainer should also listen to the evaluation, opinions and suggestions of the trainees or others.

## 5 Conclusion

In short, curriculum construction is a long-term and arduous task, and it is also the duty of trainers. Flexible teaching skills should be adopted in the training class. So that students can really acquire valuable knowledge they need for their work, life and self-development.

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