# Practical Research on School-Enterprise Cooperation in Developing Teaching Materials under Modern Apprenticeship Mode—Taking Thermal Power Engineering Technology Specialty as an Example

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**Keywords:** Modern apprenticeship; School enterprise cooperation; Textbook development

**Abstract:** Modern apprenticeship is a modern talent training mode that focuses on skills training for students through the deep cooperation between schools and enterprises and the joint teaching of teachers and masters. Modern apprenticeship is the basic institutional carrier and effective realization form of the integration of production and education, and it is also the basic trend and leading mode of vocational education development in the world. In this paper, under the modern apprenticeship mode, the practice of school-enterprise cooperation in developing teaching materials is studied. Taking thermal power engineering technology specialty as an example, the operation rules of various power engineering and machinery are studied to realize the efficient and safe use of fuel. Make a detailed analysis of the performance of thermal power engineering in order to better solve practical problems. Modern apprenticeship system scientifically and effectively realizes the combination of training and school education of thermal power engineering technology, and the combination of learners' work and study, effectively helps them learn knowledge, train skills, accumulate work experience and develop professional attitude, and meets the needs of modern economic society for technical and skilled talents, so it develops rapidly.

## 1. Introduction

Modern apprenticeship is a talent training mode based on school enterprise cooperation, with students' skills training as the core, the implementation of school courses and enterprise courses as the link, and the teaching of school teachers and enterprise teachers together. Modern apprenticeship is a modern talent training mode that focuses on skills training for students through the deep cooperation between schools and enterprises and the joint teaching of teachers and teachers [1]. Modern apprenticeship is the basic system carrier and effective realization form of the integration of industry and education, as well as the basic trend and leading mode of the development of vocational education in the world. In the process of education, it is necessary to pay attention to the cultivation of students' post professional ability and professional quality. Modern apprenticeship is conducive to promoting the industry and enterprises to participate in the whole process of vocational education talent cultivation, realizing the connection between professional settings and industrial needs, the connection between curriculum content and professional standards, and the connection between teaching process and production process, which is conducive to improving the quality and pertinence of talent cultivation [2]. In the process of exploring the modern apprenticeship system, the study of the "teacher led apprentice" teaching model is a key content that cannot be ignored. It is different from the traditional master apprentice teaching and teacher teaching, and should have a distinctive feature of integration of production and teaching, and integration of work and learning. The construction of modern apprenticeship system starts from the professional teaching standards and curriculum reform, and systematically constructs the curriculum system of "school curriculum+enterprise curriculum". The foothold is to develop a

series of project-based teaching materials and teaching resources through the cooperation between schools and enterprises. Practice has proved that it is conducive to the realization of the goal of professional talent training.

In this paper, the practice of school enterprise cooperative development of teaching materials is studied under the modern apprenticeship mode. Taking the thermal power engineering technology major as an example, the national economic construction will inevitably be accompanied by the rise of energy demand, and the energy industry has always played a very important role in national production activities. Thermal energy and power engineering is a discipline born to solve energy and power problems. Based on engineering thermophysical theory, it studies the operation laws of various power engineering and machinery to achieve efficient and safe use of fuel [3-4]. In the actual use of thermal power engineering, if you do not know much about thermal power engineering, it will not only accelerate the loss of the machine, but also can not improve the use efficiency. Therefore, we will make a detailed analysis of the performance and application of thermal power engineering to better solve practical problems. Through the study of power production process, it can be found that the application of thermal energy and power engineering plays an important role in reducing energy consumption. The characteristics of waste heat power generation can be used to minimize exhaust emissions and meet the goal of energy efficient conversion. In the whole power generation process, its role in energy conservation and emission reduction can be maximized. The modern apprenticeship system has effectively realized the combination of thermal power engineering technology professional training and school education, and the combination of learners' work and learning, effectively helping them learn knowledge, train skills, accumulate work experience and develop professional attitudes, meeting the needs of modern economic society for technical skilled talents, so it has developed rapidly [5].

## 2. Present situation of thermal power engineering

The development of thermal power engineering specialty is to standardize the theoretical level and structure of the specialty, improve the practical content of the specialty and expand the application fields of the specialty, thus forming a complete scientific system of thermal power engineering specialty with reasonable structure and complementary advantages. For thermal power engineering, in the actual operation process, the working conditions are not invariable. It is necessary not only to select the corresponding working conditions according to the actual situation, but also to constantly adjust them in the operation process [6]. Due to many reasons, the problem of electric power will be seriously affected, and there are many differences in human operation, which will easily lead to the instability of electric power, etc., and to a certain extent, it will also affect the operation, and also lead to more serious problems in generating electric energy storage. For thermal power engineering, it is often necessary to solve the problem of the pressure loss of the machine, the pressure difference between units, and the load problem. There are many ways to solve the problem, but at the same time, there are some drawbacks. In high-load areas, if sliding adjustment is adopted, it will inevitably cost more. When the mechanical energy of the larger units is not completely converted, it is often accompanied by the waste of resources.

There is an inseparable and close relationship between the actual use of heat energy and people's quality of life, and it can even directly affect it. Engineering thermophysics can be said to be the theoretical basis involved in the application of thermal energy and power engineering. Improve the erosion resistance of the unit; Application of sprinkler irrigation with suction joint, etc. In the process of steam turbine operation, in addition to overcoming the friction between thrust bearing and supporting bearing, the governor and main oil pump should also be started, and the completion of these actions requires a certain capacity loss, namely mechanical loss [7]. In the actual operation of power system, the mode of regulating voltage is usually accompanied by certain losses. First of all, we should treat the loss problem correctly. After all, the power system also operates through this operation mechanism, so it is difficult to avoid such problems to some extent. In the face of the instability of the condenser device during operation, if the changes of the condenser device during operation are found during the inspection, then these changes should be influenced by other factors

to cause the changes inside the condenser device.

Note that engineering, machinery and microelectronics are also covered by the above scope, that is to say, in the process of studying thermal energy and power engineering, comprehensive consideration of the above contents must be realized. In this process, the ultimate goal of automatic control is to gradually realize the transformation from chemical energy of liquid to kinetic energy. Moisture loss is an important component of energy consumption loss in thermal power plants. Reducing moisture loss is necessary for the effective operation of thermal energy and power engineering in thermal power plants. This paper analyzes the causes of moisture loss, mainly including the following aspects: in the process of wet steam expansion, partial condensation of steam occurs, resulting in a significant reduction in the amount of steam. When this kind of problem is found, we should attach great importance to it and immediately adjust it to ensure the safety of the whole operation. Thermal power polygeneration system is a complex system with various forms of energy input such as raw fuel and electric energy, and various forms of products and energy output such as thermal power. In this process, raw fuel, chemical products, thermal power and other energy sources are not equivalent, which makes it difficult to scientifically and reasonably evaluate the chemical thermal power polygeneration.

## 3. The Construction of Innovative Management Mode of Thermal Power Engineering Technology Major under Modern Apprenticeship System

### 3.1. Form a close school enterprise cooperation mode for thermal power engineering technology

Establish a joint training mechanism among industries, enterprises and colleges. The modern apprenticeship collaborative education organization is composed of the management personnel of the elevator industry, enterprises and colleges, and the "double professional and part-time teaching team" is composed of the technical experts of the elevator industry, enterprises and professional teachers of the school, who jointly participate in the whole process of professional construction, teaching reform and talent training. For thermal power engineering, the phenomenon of heavy heat cannot be avoided. To be exact, the essence of thermal power is the phenomenon of heavy heat. The structure of the steam turbine can effectively use the residual force of heavy heat in a multi-layer way, which is called the orderly use of heavy heat. The heat coefficient is emphasized in the determination of melting drop [8]. If the phenomenon of steam emission exists in the operation process of deaerator, it will threaten the heat and quality. In order to further reduce the heat loss, we need to use the cooler to continuously optimize the thermal power system, and further reduce the probability of errors. According to the national professional standards, starting from the actual production and taking professional skills as the main line, the professional ethics and safety production of this type of work, as well as the theoretical knowledge and operating skills that should be mastered are introduced. In the form of teaching materials, in addition to the preparation of traditional paper teaching materials, multimedia courseware, teaching software, visual three-dimensional teaching materials have also been developed. Taking the thermal power engineering technology specialty as an example, the flow chart of the close school enterprise cooperation mode of thermal power engineering technology specialty is shown in Figure 1.

Establish a modern apprenticeship operation mechanism and management regulations for in-depth cooperation between schools and enterprises, and make effective use of reheating through interlocking personnel training links such as joint enrollment interview, integration of enterprises into start-up education, co-construction of curriculum system, co-teaching of courses, co-guidance of practical training, and co-guidance and evaluation of posts. The greater the reheating coefficient, the more favorable it is for thermal power engineering. In order to make full and reasonable use of reheating phenomenon, we should set the corresponding numerical proportion and take effective measures to heat it up and The expired pressure will directly affect the vaporization of water vapor, and the insufficient temperature will directly affect the vaporization of liquid water, and the work efficiency of steam will be seriously damaged in this process. The unit problem is solved, and it is

better for thermal power engineering. Realize the operation mode of school-enterprise cooperative education, formulate specific management regulations and systems, and effectively implement the cooperative education mechanism.

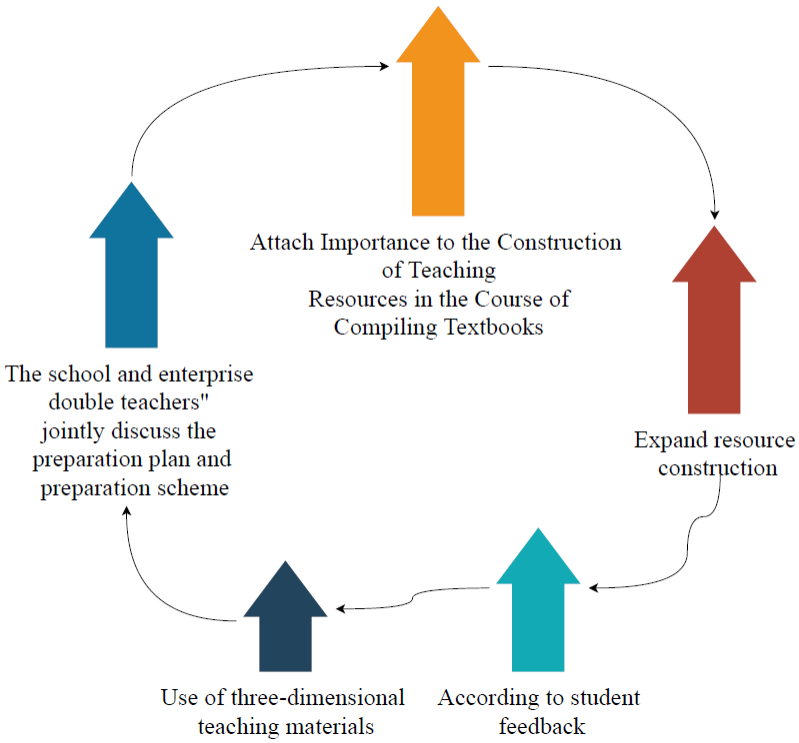


Figure 1 Flow chart of close school-enterprise cooperation mode of thermal power engineering technology specialty

### 3.2. Enterprises participate in the whole process of training talents of thermal power engineering technology

Selecting talents from the perspective of employment of industry enterprises will make school-enterprise cooperation run through the whole process of sustainable development of professional talents training, and deeply intervene in the admissions interview process. From the perspective of employment of industry enterprises, the standards that industry enterprises should possess and have potential for talents' quality, skills and knowledge are formulated, so that the school's talent training can learn from and apply the employment standards of industry and enterprises from the initial link, and the professionalism of talent training can be guaranteed to the maximum extent. The reheat phenomenon in the power category is the heat loss within a small part of the turbine with multi-level structure. Such reheating can also be utilized during the subsequent operation. The proposed reheat coefficient is set in comparison with the baking drop in the best case. Under the ideal condition, the baked drop, the remaining part, represents this kind of ratio. Get through the enterprise promotion channel in advance. Due to the deep involvement of enterprises in the training in the previous two years, students can fully perform on-the-job operation during the on-the-job internship stage, and the responsibilities of enterprise masters are transformed into "business guidance and coordination and communication". According to the needs of self-development, this paper puts forward the corresponding curriculum and target requirements of talent training, which is carried out by the college, which meets the requirements of the employer for talents. After graduation, all students are accepted and arranged by the employer. See Table 1 for the basic situation of order training.

Table 1 List of Order based Talent Training

| Serial No | Training unit | Major | Training degree | Number of trainees | Training time |
|---|---|---|---|---|---|
| 1 | Company A | Thermodynamic | Specialty | 62 persons | 4 years |
| 2 | Company B | Thermodynamic | Specialty | 30 persons | 3 years |

Reducing the moisture loss in thermal power engineering is the top priority of the project. Based on previous experience, there are several reasons for the moisture loss. When the steam is wet, it often expands and then solidifies again, which will affect the total amount of steam. Once the flow rate exceeds the original, it will inevitably cause some loss. Once the moisture loss reaches the characterization, it will further affect the inlet edge of the moving blade, The arc inside the moving blade will also be gradually lost. Therefore, on the basis of fully mastering the post operation process and business project tasks, students with excellent performance can break the rules and enter the next step of the career promotion plan ahead of time, implement competitive employment, highlight the characteristics of the "incentive+competition" talent training and promotion system for thermal power engineering and technology professionals, and closely follow the employment mechanism and style of the industry and enterprises.

## 4. Conclusions

The modern apprenticeship vocational education reform system fully highlights the "school-enterprise dual education subject", and through the close cooperation between school and enterprise, the enterprise integrates into the whole process of professional personnel training in the school, so as to scientifically and effectively cultivate technical and skilled talents with high professional qualities which are consistent with the employment standards of industries and enterprises. In this paper, the practice of school-enterprise cooperation in developing teaching materials is further studied under the modern apprenticeship mode. Taking thermal power engineering technology specialty as an example, it is an important means to change the above phenomenon by fully applying thermal power engineering technology from the perspective of production process, and further reduce the probability of pressure regulation. In the detailed analysis of thermal power engineering, such as harmonic working conditions, reduction of pressure regulating loss, orderly application of reheat, throttle adjustment and reduction of moisture loss, we have learned the advantages and disadvantages of thermal power engineering, and found that thermal power engineering still needs in-depth study to make the system more perfect, and the development of enterprises can not be separated from the research of thermal power engineering. Under the background of modern apprenticeship system, the teaching place has been extended to the enterprise site, and the number of teaching teachers has increased. The unilateral teaching supervision of the school can no longer meet the requirements, so the school teaching organization and leadership need to carry out functional docking with the enterprise management organization to share the management responsibilities.

## Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.


## Acknowledgement

The development and practice of school-based teaching material of thermal instrument and control course for thermal power specialty based on modern apprenticeship in higher vocational colleges 2022SZX133


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