

# *Common Mistakes and Countermeasures of Using Learning Material in the Project-Driven Applicational Technology Courses—Taking the Teaching of Air Conditioning Course as an Example*

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**Abstract:** Project-driven teaching is an improvement of traditional teaching method based on knowledge-driven system. It emphasizes that the teaching process is driven by the implementation of the project, rather than based on traditional textbooks. Therefore, there are some disputes about how the textbook should play its role correctly in the project-based teaching. In the process of implementing project-based teaching, some views hold that since it is driven by project, it is nature to abandon the traditional textbooks; others, on the other-hand, continue to organize teaching only or at least mainly based on textbooks. The third part of people think that the project-based curriculum must have special Project-based Curriculum textbooks, so the textbook should be written as an operation manual according to the project order. The author makes a detailed analysis of the three views on the use of textbook in the project-based curriculum, and then puts forward my own views.

## **1. Introduction**

At present, the application-oriented courses in Colleges and universities often integrate a variety of disciplines and technologies, for example, the "air conditioning technology" is a typical course of this kind, which includes thermal engineering, fluid mechanics, architecture, machinery, electrical and electronic, automatic control and other technologies. Its application is very wide, involving the construction, transportation, precision manufacturing, biopharmaceutical, medical, aerospace, and other fields.

The theory of "air conditioning technology" is very abstract, but the technology is extremely complicated, which brings great challenges to the implementation of project-driven teaching. Therefore, the teaching emphasis of this kind of course is difficult to grasp and easy to fall into misunderstanding.

One good idea is to carry out the teaching of these courses according to the project-driven teaching method. Many articles have described their beneficial exploration on the teaching reform of project-driven curriculum and achieved great results. In the process of implementing project-based teaching, some people think that since it is driven by project, we must abandon the traditional

textbooks, while others continue to organize teaching mainly by traditional textbooks. Some people think that the project-based curriculum must have special project-based curriculum textbook, and that the project-based curriculum textbooks should be like an operation manual written in accordance with the order of the project.

There are many literatures discussing the development textbook for project-driven courses [1] [2] [3] [4]. However, they didn't address the issue of the common mistakes listed above. This paper takes "air conditioning technology" course as an example, makes a detailed analysis of the three views on the use of textbook in the project-based curriculum, and then puts forward my own views.

## 2. Misunderstanding of Textbook in Project-Driven Teachings

### 2.1 Mistake 1: Textbook are only for knowledge-based teaching rather than project-driven teaching

One point of view is that the textbooks represent the knowledge-based teaching thinking and are the stumbling block of project-driven teaching. Wrong! In fact, the textbook itself should not be blamed, it is we the instructors that have made a deviation in the macro teaching design while implementing the project-driven curriculum.

Like many application-oriented courses, "air conditioning technology" is also an Interdisciplinary Applied Science, involving complex equipment, various theoretical and empirical formulas, and many specifications and technical requirements details. Therefore, to meet the requirement of higher standard, integrity and practicability, the textbook of air conditioning technology needs to be written covering all aspects, just like an encyclopedia. Such kind of textbook of air conditioning technology is not a stumbling block of project-driven teaching, on the contrary, a good practical textbook in that style is the best helper to complete the project-driven teaching.

The key point is that carrying out the project-driven teaching of the course requires us to re-organize the teaching plan, instead of explaining everything in detail according to this textbook. Explaining everything in detail according to the textbook seriously violates the original intention of the textbook and the principle of project-driven teaching method.

We must learn to choose. We must realize that these encyclopedia-like contents in the textbook are for reference and need to be explained in a detail only to a controlled extent, we should never force students to remember such details of the textbook, let alone test them in exams. For example, "what is the basis of outdoor air calculation parameters" is a typical type of knowledge. These contents often have one of the following characteristics: declarative knowledge, involving tedious theoretical formula or empirical formula, involving the national legal norms and conventions, belonging to local "equipment component level" knowledge rather than "system level" knowledge.

Therefore, in the use of air conditioning technology textbook, we should grasp the right key points, focus on the "system level" knowledge and skills, pay limited attention to the "equipment component level" knowledge and skills. These "system level" teaching contents often involve the overall macro system architecture of the central air conditioning system. When students complete the construction of the air conditioning system project of this course, they must have these knowledge and skills, which happen to be easy to remember and they are a must for future study and career. The purpose of explaining the knowledge and skills of "equipment level" is to better learn the knowledge and skills of "system level". For too detailed knowledge and skills, we should focus on guiding students to learn how to look up the textbook as well as the manual, and quickly locate and search. And the skill of searching information in this way is also an important skill that mature engineers must learn.

## 2.2 Mistake 2: Implement the project-driven teaching mainly or only based on textbooks

Due to the limitation of paper size and space, even the encyclopedia-like textbooks cannot include the actual construction drawings, equipment product samples, national laws and regulations and other information needed for the actual project implementation and furthermore, textbook cannot replace the engineering site. If the project-driven teaching is limited to the use of textbooks and separated teaching from drawings, equipment samples and on-site teaching, it will be out of touch with the actual engineering, resulting in students unable to complete the project, or at least the project results will be out of touch with the actual.

Project based teaching is based on constructivism teaching theory, that is, to "construct system" in students' mind, a complete air conditioning system design. The problem is that teaching students to build out of thin air, I am afraid they can't even build castles in the air.

To complete the project construction, students should first read a large number of standardized, complete and moderate sized actual construction drawings.

Drawings are the language of engineers and reading and analyzing drawings is the soul of project-based teaching of the air conditioning technology course.

In addition, students must be guided to find and understand the product specifications of air-conditioning equipment and components, to understand the performance, characteristics, price, selection index and basis of equipment and materials, which are necessary to complete the project with high quality.

On the other hand, it's still on paperwork to have drawings and equipment specifications without going to the site. Instructors should find some operating air-conditioning sites. Combined with the course schedule, the instructor can observe the operation at any time, so that the classroom teaching and site teaching can be completely integrated.

For any project-driven course, there should be demonstration videos recorded by instructors, as well as several professional websites. In this way, construction sites, textbook, drawings, videos, and industry websites, students are supported by a variety of teaching resources when they implement of the course project.

## 2.3 Mistake 3: Project-driven teaching needs operation-manual like textbooks

This point of view is that since we have implemented the project-based teaching of the course, the textbook should follow the implementation sequence of the project, write the operation steps and methods clearly in order, and the students can complete the project by following the textbook.

Actually, such operation manual like so-called "project-driven" textbook is even worse than the traditional textbook based on knowledge deduction system.

Because project-based curriculum is a practical version of constructivism teaching theory. The purpose of implementing project-based curriculum is to let students learn by doing, not do without thinking. The purpose of doing is to learn, learn to complete a higher form of doing.

Operation manual type project-driven textbook are commonly used in computer courses. The teacher takes the students to knock out the code along with the textbook. After the students knock the code, they seem to have completed a beautiful project, but in fact they learnt nothing, because they can't modify any part of code according to the needs of the new project.

The same is true in the teaching of "air conditioning technology". If the teacher just takes the students to complete a project step by step, it is extremely easy to complete, but is that good to students? In fact, it deprives students of the process of exploration, thinking and trial and error. Even if Such a student completed a beautiful small project, but with conditions slightly changed, they cannot complete a new project.

A good project-based textbook can be organized with project-driven implementation sequence,

but we must fully explain why we need to do like so, instead of just making students to complete some actions. Otherwise, even if the project is completed, in fact, students only learn a series of actions, not the reasons behind the actions, so they cannot do not anything about know-how.

### 3. Conclusion

The correct way is to use a variety of teaching materials flexibly, and even let students search for learning materials by themselves.

Requirements of project implementation should be taken as the main axis. The project implementation process and assessment progress should be announced on the first day of class. Students should be aware of the project implementation process and assessment progress in the first day of class.

When the task is announced, the teacher should not make a complete demonstration in a hurry, but let the students form a group to search the learning reference materials by themselves. The teacher can tell the students what problems need to be solved, where and how to find the answers, and then discuss them together.

Flexible application of teaching materials, drawings, equipment and product instructions should be applied, and we must not forget to lead students to carry out on-site teaching.

Special teaching website can be setup to share all these teaching resources with students, encourage extracurricular learning and in class discussion, so as to make up for the shortage of in class teaching time limitation of knowledge stock, profit rate and valuation can further improve the innovation performance of enterprises.

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