Case Teaching Method in “Field Bus Control System” Application Practice in Curriculum Design

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Abstract. “Field Bus Control System” is a practical course, in which Case-based teaching can be adopted to inspire students’ study enthusiasm and improve the teaching effect. The Case-based teaching includes collection and selection of the case, analysis and discussion of the case, summary of the case and writing report. In this paper, in order to establish a teaching case resource library, deal with the relationship between case teaching with other teaching methods correctly and guide the students to participate in the process of case teaching, self-learning and innovation learning, a new teaching method has been proposed by introducing Case-based teaching in curriculum design and choosing typical cases in teaching course. The proposed teaching method is beneficial to innovation and entrepreneurship of students so that can achieve the cultivation objectives of “innovative and entrepreneurial talent”, which cannot be done by traditional experiment lessons.

1. Introduction

As is known to us, Case-based teaching is well known for its successful application at Harvard University Business School and widely praised by the education community. In the 1980s, China began to use the Case teaching, which is mainly used in law, medicine, economics, and management and so on [1-3]. However, Case teaching is almost ignored in engineering courses. Curriculum design in engineering is one of the core practice trainings for students, which is a very strong application of professional courses. In order to optimize the teaching effect and improve the ability of analyzing and solving the problem, we try our best to introduce the engineering case into the engineering course teaching, and establish the organic connection between the theory and the practical application [4]. Therefore, we try to apply the project case teaching into the curriculum design of the field bus control system course, and have achieved some useful results.

2. The Connotation of Case Teaching

Case is the core of Case teaching. One of the most prominent features of Case teaching is case application, which is the key to distinguish case teaching from other methods [5]. So, what is the case? Different people have given different views according to different points of view and position. On the basis of the view of the scholars, from the engineering point of view, I believe that the so-called case, that is, for a certain purpose of teaching, around the selected issues to find facts, and write a particular project application objective description. In general, the case should have the following basic characteristics:

2.1 Authenticity.

For engineering courses, the purpose of the case is to help students understand the engineering practice and strengthen students’ experience. Therefore, the case should be rely on the actual work rather than based on virtue of personal imagination and creativity. Of course, in order to highlight the theme, cut processing is permitted in the narrative of the case.
2.2 Integrity.
   The narrative of the case should have a complete description, which includes not only the
   background of the engineering application, the specific process, the strategies and methods to solve
   the problem, but also the results of the problem solving.
2.3 Typical.
   The case should be a typical example, which represents the essential nature of a class of things or
   phenomena. The case should summarize and radiate a large number of theoretical knowledge, so that
   students can master the relevant principles and methods. Meanwhile, the level of student knowledge
   and ability should also be considered to make the teaching content match students.
2.4 Enlightening.
   The case should be able to be thought-provoking and enlightening ideas, which can provide
   students with the needed imagination and space.

3. The Difference between Case Teaching and Examples
   Although the teaching case and examples both illustrate a certain truth through certain examples,
   they are essentially different [6-7].
3.1 Different teaching methods.
   Case teaching is the discussion of teaching, and the information flow is two-way. On the contrary,
   example is the teaching of teaching, and information flow is mainly one-way.
3.2 Different subject.
   In the case teaching, the students are the main position in the whole teaching activity. On the
   contrary, the teacher occupies the main position in the whole example activity.
3.3 Different purpose.
   The case teaching pay attention on improving students’ ability to analyze and solve problems
   through case studies, and the purpose of example teaching is to make students know how to apply a
   principle or to deepen the understanding of a problem by examples.
3.4 Different Coverage.
   The cases proposed in the case teaching are covered in a wide range of areas, which is
   comprehensive. The examples proposed in the examples are often accompanied by the traces of the
   example, and the knowledge covered is local.
3.5 Different ways of thinking.
   The Case teaching is a reverse thinking, and its knowledge and principles are hidden in the case,
   which requires think about “what theories and techniques to use to solve the problem”. The example
   is to use the known principle to verify its effectiveness, which is a positive way of thinking. Its
   knowledge and the principle are directly presented in front of students, needing to think about is “how
   to use a theory and technology to solve the problem”.
3.6 The results are different.
   The results of the Case teaching are diversified, and the results of the examples are determined.

4. The Advantages of Case Teaching
   As one of the effective teaching methods of modern education, the Case teaching has obvious
   advantages [8].
4.1 Contribute to the combination of theory and practice.
   “What is the knowledge of this course?” This is a problem that often bothers students in the
   learning process. The Case teaching introduces theory and practice into a specific teaching
   environment, examines the relationship from different point of view, and sets up a bridge between
   theory and practice. Case analysis promotes students to use the theory by more in-depth thinking,
   which result in students to make use of theoretical knowledge with complete understanding rather
than a simple memory. The purpose of the Case teaching is to let the practice experience of students in the community be ahead of the teaching process, so that students can obtain some certain actual combat experience in the learning process.

4.2 Help students develop the ability to analyze problems and solve problems.

In the case teaching, students learn how to understand the problem by asking questions, how to find the problem through information, how to change the way to thinking problem and finally solve the problem when the students understand the background of the case, obtain the relevant information and discover the case problem, which gives students opportunities to understand, analysis and solve practical engineering problems. Obviously, the focus of case teaching is to discuss and analyze, that is, the thinking ways and ability of solving the problems.

4.3 Help to stimulate students’ enthusiasm and initiative for learning.

The cases are all real event in the practice of the project, which are vivid and infectious. Therefore, the cases make students feel like visiting the scene in the classroom, which can mobilize the emotions of students. The Case teaching urges students to find information, search the answer and solve the problem by themselves, which can stimulate students to learn initiative, changing “I have to learn” to “I want to learn” to a certain extent.

5. The Implementation of Case Teaching In Professional Curriculum Design.

The implementation process of the Case teaching in the practical application is shown in Fig. 1, which are the choice of cases, the preparation of teaching process, classroom organization, after-school communication, summed up the reflection and feedback a few steps.

![Figure 1. The implementation process of Case teaching.](image)

5.1 Choice of the case.

The case is the basis of Case teaching, and the choice of the case is the key to the Case teaching, which has a direct impact on teaching efficiency. Therefore, we should selected cases carefully according to requirements of case teaching. At the same time, the case must be meaningful to the students and be consistent with their psychological development stage, knowledge development level, way of thinking and society activities, so that students can feel important and interesting about the case. According to work experience, the author chooses the “real-time simulation monitoring system” of the actual project as a case, which is a practical application system. This case is closely related to
the students’ specialty. Therefore, it is not only easy to attract students’ interest, but also easy to be understood and accepted by students.

5.2 Preparation for teaching process.

The success of case teaching depends on the joint efforts of teachers and students, which requires participation and cooperation of the both sides. Fig.2 shows that a successful case teaching not only requires students to prepare carefully before class, but also needs teacher to try his best to prepare for lesson.

5.2.1 Analysis of cases.

Teachers should be familiar with the case, study the contents of the case and the relevant sections of the textbook, so that students can learn and master the related principles and knowledge by the case. For example, the “Field bus control system” case includes the knowledge of electronic circuit, C language, single-chip principle and network and so on.

5.2.2 Design the lesson plans.

Identifying and listing issues in regard to this case teaching which need to place more attention is the first step. The key to “field-bus control system” case is how to design the circuit structure rationally and how to use multi-process and multi-threaded thinking. The analysis and discussion of the “field-bus control system” case can be carried out in accordance with the software engineering approach. Finally, the time allocation for the discussion is also need to be projected, since the case discussion usually is dynamically, and it can not be done exactly as instructed by the teacher, therefore, the teacher should summarize and conclude at the appropriate time.

5.2.3 Dispense the teaching material.

Dispensing the teaching material in regard to the case, the background knowledge associated with the case and the theoretical description of reference materials, etc, as Fig.2 to the students before the class, in order to facilitate students to prepare in advance.

5.2.4 Visit the actual site.

Organize students to visit the car detection line system with field bus control unit. Only in the face of practical application, then students can understand the relationship between theory and practice much better, and then stimulate the interest of learning.
5.2.5 Case study: Control System Device Based on 485 Bus.

The control system which based on the 485 bus device with ATmega128L as the core, prepare the computer interface software in the use of configuration software, control digital input module DI through the 485 bus, output module DO digitized, input module AI and output module AO analogy. Furthermore, it can show the system running in the computer interface. The device can realize long-range and multi-point control; accordingly, it has been the upgrade product of PLC and DCS system.

5.3 Class organization.

Guiding students to discuss, rather than the teacher-based teaching is the main class mode. Teachers should listen carefully to the students’ speeches and be good at discovering and capturing the glimpse of their speeches. Pay attention to observe and understand the students’ reflection and performance, mobilize the enthusiasm of students timely in order to avoid the phenomenon of cold field; moreover, pay attention to encourage all students in the class are actively involved in the discussion as much as possible. In the beginning of the “field bus control system” case teaching, as students are not familiar with the case teaching and can not focus on the point of thinking, so the classroom atmosphere is much boring. In this case, the author should inspire students to think deeply with professional curriculum design knowledge as the starting point for promptly and focus on the main issues, some students’ active thinking and speech, bring about the whole classroom atmosphere actively gradually and then we can obtain better teaching effect.

5.4 After-school communication.

The end of the classroom discussion does not mean the end of the case teaching. After-school communication is one of the important measures to improve the quality of case teaching. After class, each student needs to talk about the feeling of this case to find shortcomings about the case teaching and the work of teachers. Students feedback indicate that, students generally believe that this teaching method novelty, tightly close to the actual, guide students to actively think about, improve the interest of students and the ability to analyze and solve the problem. From the student feedback on the curriculum teaching it can be seen that this participatory teaching form is welcomed by students.

There are also some problems in the implementation of the teaching process, such as students are not familiar to the case teaching form, not adapt at the beginning; lack of background information related to the case; less time for students to think deeply and so on.

6. Some Thoughts on Case Teaching.

6.1 Establish high-quality teaching cases.

The prerequisite for case teaching is to have a case. Professional curriculum design itself covers many content, the establishment of the case should not only cover enough knowledge points, but also have the appropriate size. If the case size is too large, it is difficult to be accepted by students in a short time, which will impact the desired teaching effect; while the case size is too little; we can’t insert enough knowledge, and also can not provide enough research and thinking space. Only after a long period of accumulation, deeply thinking, careful choice, many time teaching practice, we can obtain high-quality teaching cases.

6.2 Improve the enthusiasm of teachers to conduct case teaching.

In the process of case teaching, the duty of teacher change largely, from the main speaker of traditional teaching into the organizers of teaching activities. Case teaching requires teachers not only familiar with the theoretical knowledge and background of the case, but also possessing the ability to master the process of research. When discussing deviate from the teaching course, the teacher should guidance them timely; when the atmosphere of discussion tend to be indifferently, the teacher should promptly stimulate students; when the discussion only in the text surface, the teacher should inspire them properly. Therefore, the case teaching require more, teachers should have a profound and
extensive professional knowledge, and devote more energy. As a result, appropriate mechanisms should be established to improve the enthusiasm of teachers to conduct case teaching.

6.3 Guide students to adapt to the case teaching model.
Case teaching is the student-centered teaching, students actively participate in cooperation, is the key to the successful implementation of case teaching. For a long time, students have been accustomed to the learning model: listen to the teacher, write their own notes, complete homework. When it comes to the problem-based learning and discussion learning, they may confused and unfamiliar, and have no idea on how to access information, analysis problem and write reports. This requires teachers on the one hand dispense the case teaching material in advance and take stage inspection, guide and urge students to familiar with the case, gain the useful information extensively, make the report outline, prepare for the discussion; on the other hand to guide students to learn how to write an analysis of the case teaching process, sort out a lot of knowledge and guide students to adapt to the case teaching model.

6.4 Combine case teaching with practical teaching.
Three levels of experimental curriculum design requirements, namely, basic and validation experiments, design and development experiments, research and innovative experiments. Among them, research and innovative experiment is a kind of open type experiment, focusing on cultivating students’ research ability and innovation consciousness. This type of experiment may have not a single result, even without the end result, but the process is very important, requiring students provide experimental analysis and research reports, write insights experience. Therefore, the case teaching and practice teaching can be combined organically, based on the background of the case study and innovative experimental topics, so that students practice, experience the practical process of solving the whole process, give full play to imagination and creativity in practice and experience, and then improve and perfect the case solution.

7. Conclusion
In a word, case teaching method is under the guidance of teachers, according to the purpose and requirements of teaching, taking the case as the basic teaching material. Furthermore, the students should devote themselves think into a specific teaching context, in order to deepen the understanding of the basic principles and concepts, and then cultivate and improve themselves use theoretical knowledge to analyze problems and solve problems with a teaching method.

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9. References

